MATHEMATICS STANDARDS OF LEARNING ENHANCED SCOPE AND SEQUENCE

Grade 3
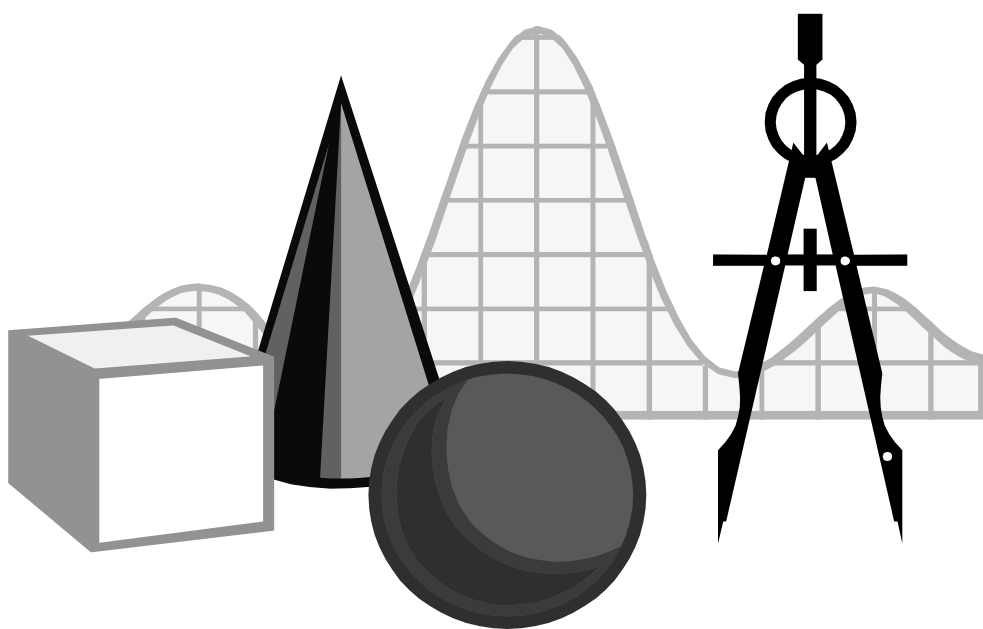
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Introduction

The *Mathematics Standards of Learning Enhanced Scope and Sequence* is a resource intended to help teachers align their classroom instruction with the Mathematics Standards of Learning that were adopted by the Board of Education in October 2001. The Mathematics Enhanced Scope and Sequence is organized by topics from the original Scope and Sequence document and includes the content of the Standards of Learning and the essential knowledge and skills from the Curriculum Framework. In addition, the Enhanced Scope and Sequence provides teachers with sample lesson plans that are aligned with the essential knowledge and skills in the Curriculum Framework.

School divisions and teachers can use the Enhanced Scope and Sequence as a resource for developing sound curricular and instructional programs. These materials are intended as examples of how the knowledge and skills might be presented to students in a sequence of lessons that has been aligned with the Standards of Learning. Teachers who use the Enhanced Scope and Sequence should correlate the essential knowledge and skills with available instructional resources as noted in the materials and determine the pacing of instruction as appropriate. This resource is not a complete curriculum and is neither required nor prescriptive, but it can be a valuable instructional tool.

The Enhanced Scope and Sequence contains the following:
- Units organized by topics from the original Mathematics Scope and Sequence
- Essential knowledge and skills from the Mathematics Standards of Learning Curriculum Framework
- Related Standards of Learning
- Sample lesson plans containing
  ° Instructional activities
  ° Sample assessments
  ° Follow-up/extensions
  ° Related resources
  ° Related released SOL test items.

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Organizing Topic   Whole Numbers: Representations, Relationships, Operations and Estimation

Standards of Learning

3.1   The student will read and write six-digit numerals and identify the place value for each digit.

3.2   The student will round a whole number, 9,999 or less, to the nearest ten, hundred, and thousand.

3.3   The student will compare two whole numbers between 0 and 9,999, using symbols (>, <, or =) and words (*greater than, less than*, or *equal to*).

3.4   The student will recognize and use the inverse relationships between addition/subtraction and multiplication/division to complete basic fact sentences. Students will use these relationships to solve problems such as $5 + 3 = 8$ and $8 – 3 =$ ____.

3.8   The student will solve problems involving the sum or difference of two whole numbers, each 9,999 or less, with or without regrouping, using various computational methods, including calculators, paper and pencil, mental computation, and estimation.

3.9   The student will recall the multiplication and division facts through the nines table.

3.10   The student will represent multiplication and division, using area and set models, and create and solve problems that involve multiplication of two whole numbers, one factor 99 or less and the second factor 5 or less.

Essential understandings, knowledge, and skills	Correlation to textbooks and other instructional materials
The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to	
• Investigate and identify the place value for each digit in a six-digit numeral, using base-10 manipulatives (e.g., base-10 blocks).	
• Read six-digit numerals orally.	
• Write six-digit numerals that are stated verbally or written in words.	
• Round a given whole number, 9,999 or less, to the nearest ten, hundred, and thousand.	
• Solve problems, using rounding of numbers, each 9,999 or less, to the nearest ten, hundred, and thousand.	
• Describe the meaning of the terms *greater than, less than*, and *equal to*.	
• Determine which of two whole numbers between 0 and 9,999 is greater.	
• Determine which of two whole numbers between 0 and 9,999 is less.	

- Compare two whole numbers between 0 and 9,999, using the symbols >, <, or =.

  _____

- Use the inverse relationships between addition/subtraction and multiplication/division to solve related basic fact sentences. For example, 5 + 3 = 8 and 8 – 3 = __; 4 × 3 = 12 and 12 ÷ 4 = __.

  _____

- Write three related basic fact sentences when given one basic fact sentence for addition/subtraction and for multiplication/ division. For example, given 3 × 2 = 6, write __ × 3 = 6, 6 ÷ 3 = __, and 6 ÷ __ = 3.

  _____

- Determine whether to add or subtract in problem situations.

  _____

- Determine whether an estimate is an appropriate solution for addition and subtraction problems.

  _____

- Add or subtract two whole numbers, each 9,999 or less.

  _____

- Estimate and find the sum of two whole numbers, each 9,999 or less, with or without regrouping, using calculators, paper and pencil, or mental computation.

  _____

- Estimate and find the difference of two whole numbers, each 9,999 or less, with or without regrouping, using calculators, paper and pencil, or mental computation.

  _____

- Solve problems involving the sum or difference of two whole numbers, each 9,999 or less, with or without regrouping.

  _____

- Recall and state the multiplication and division facts through the nines table.

  _____

- Recall and write the multiplication and division facts through the nines table.

  _____

- Model multiplication, using area and set models.

- Model division, using area and set models.

  _____

- Solve multiplication problems, using the standard multiplication algorithm, where one factor is 99 or less and the second factor is 5 or less.

  _____

- Create and solve word problems involving multiplication, where one factor is 99 or less and the second factor is 5 or less.

  _____

Build the Bigger Number

Reporting category   Whole Number and Number Sense
Related Standards of Learning   3.1, 3.3

Objectives

- Students will gain an understanding of place value by creating numbers.
- Students will compare three numbers using the symbols >, <, and =.

Materials needed

- Recording Sheet, one copy for each student
- "Place Value Chart — Whole Numbers," one copy for each student
- "Place Value Chart — Decimals," one copy for each student (optional)
- "Number Card," one set for each student, *or* one 0-to-9 spinner per group

Instructional activity

1. *Initiating Activity:* Introduce the game by reviewing place value of whole numbers. Use the overhead to model the game with them, explaining that the object of the game is to build the biggest four-digit number. Ask two student volunteers to help demonstrate the game.
2. Divide class into groups of three students each, and distribute either a set of number cards to each student or a spinner to each group.
3. To decide which student goes first, the three students in each group mix their number cards and place all of them face down in a pile. Have each student draw a card (or spin the spinner). The highest number of the three goes first.
4. Player 1 draws a card and sets it in the desired place on his/her own place value chart. Once a card has been placed, it cannot be moved. Remind students that each player is trying to build the largest four-digit number they can. (If they are using a spinner, record the digit in the desired place.) Player 2 then draws a card or spins and sets it in the desired place on his or her own place value chart.
5. Talk about strategies that the students have used and why. These can be recorded on chart paper and posted for children to think about as they play the game. Highlight the mathematics used in the game. At the end of the game, have students share new strategies or talk about what happened when they tried someone else's strategy.
6. Play continues to the left until each of the three players has built a four-digit number. Have them verify the largest number. The group records all three numbers on the recording sheet and places the proper symbol between them. Numbers should be recorded from smallest to largest. The player with the largest number wins one point. Play continues until one player has a score of 10.

Sample assessment

- Walk around the room and watch and listen as the class is playing. Watch for strategies that might be used. Question groups to be sure they understand what they are doing. Check frequently to make sure that proper comparisons are being made.

Follow-up/extension

- The same game can be played with decimals through hundredths.

Number Cards

0	1	2	3	4
5	6	7	8	9

Recording Sheet

Record each number, smallest to largest
and then place >, <, or = in each O.

Name→

						WINNER		
						1	**2**	**3**
Round 1	___	O	___	O	___			
Round 2	___	O	___	O	___			
Round 3	___	O	___	O	___			
Round 4	___	O	___	O	___			
Round 5	___	O	___	O	___			
Round 6	___	O	___	O	___			
Round 7	___	O	___	O	___			
Round 8	___	O	___	O	___			
Round 9	___	O	___	O	___			
Round 10	___	O	___	O	___			

Place Value Chart – Whole Numbers

Thousands	,	Hundreds	Tens	Ones

Place Value Chart – Decimals

Hundreds	Tens	Ones	•	Tenths	Hundredths

Domino Addition

Reporting category   Whole Numbers: Representations, Relationships, Operations and Estimation

Related Standard of Learning   3.8

Objective

- Students will practice basic addition in a game format.

Materials needed

- "Domino-Addition Recording Sheet," one copy for each student
- Set of double six dominoes (28 pieces), one for each group (see follow-up/extension below)
- Calculator (optional)

Instructional activity

1. *Initiating Activity:* Review briefly the concept of place value. Explain that the object of the game is to add numbers on dominoes and get as close to 100 as possible without going over. Use a transparency of the recording sheet and an overhead set of dominoes to demonstrate the game.
2. Divide the class into groups, and have each group place their dominoes dot-side down on the playing area. Decide how many turns each player will take.
3. Each player selects a domino at random and places it on his or her recording sheet. The player decides which side of the domino to place in the tens column and which side to place in the ones column on the recording sheet and records their value.
4. Each player keeps a running record of his or her own domino total on the recording sheet. The player who gets closest to 100 without going over is the winner. A player who gets a total of exactly 100 earns a bonus point.

Sample assessment

- Walk around the room and watch and listen as the groups play. Watch for incorrect recording. Answer any questions. The mathematics in the game needs to be discussed with the children. Have students share their strategies.

Follow-up/extension

- If you are using a double-nine set of dominoes, increase the total used as a target. The same game could be played using a double-twelve or double-fifteen set of dominoes.
- You can alter the game by starting with a target number and subtracting until the total is close to five or zero.

Domino-Addition Recording Sheet

Domino	
Tens	**Ones**

Hundreds	Tens	Ones	
			Domino value or previous value
+			**Domino value**
			TOTAL
+			**Domino value**
			TOTAL
+			**Domino Value**
			TOTAL
+			**Domino Value**
			TOTAL
+			**Domino Value**
			TOTAL
+			**Domino Value**
			TOTAL
+			**Domino Value**
			TOTAL

Multiplication Baseball

Reporting category   Whole Numbers: Representation, Relationships, Operations and Estimation

Related Standard of Learning   3.9

Objective

- Students will practice multiplication and division facts in a game format.

Materials needed

- Index cards with the basic multiplication and division facts on them
- Calculator

Instructional activity

1. *Initiating Activity:* Explain to the class that they are going to play a game of baseball. Rather than using a bat and a ball, they are going to use multiplication and division facts. Rather than getting three strikes for an out, an incorrect answer is an out. Label home plate and first, second, and third bases around the room. Designate a pitcher's mound. Divide the class into two teams of nine. If there are remaining students, designate one to be the home plate umpire, one or two to be the scorekeeper(s) — one for the actual score and to keep track of outs and innings, and one to be the commissioner. The commissioner is armed with a calculator. Have each team decide on the positions the members will play. Toss a coin to determine who bats first.

2. Give the pitcher (as the teacher, you may want to reserve this position for yourself) the set of index cards with the multiplication and division facts on them. The first batter goes to the plate and the pitcher verbally "tosses" a fact to the batter. The batter responds. The umpire determines if the response is correct. If it is correct, the umpire calls, "Hit" and the batter proceeds to first base. If the response is incorrect, the umpire calls, "Out" and the next batter comes to the plate. (If the umpire makes an incorrect call, the commissioner overrules him or her.)

3. Play continues until three outs have accumulated and the teams trade places.

4. Play continues until nine innings have been played. The winning team has the most runs at the end of nine innings. In case of a tie score, extend the game to extra innings.

Sample assessment

- Record hits and outs for each student as they come to bat. Watch for common errors.
- Debrief the activity with the students to talk about strategies for improving their "play," just like a real baseball player might analyze his or her own strengths and weaknesses to improve.

Follow-up/extension

- This activity can be done at any time during the day — as a filler while waiting to go to lunch or a special activity.

Sample resources

http://standards.nctm.org/document/chapter5/numb.htm#bp1 – NCTM Principals and Standards for School Mathematics chapter on the Number and Operations Standard for Grades 3-5.

http://www.linkslearning.org/Teachers/1_Math/6_Learning_Resources/1_Illustrated_Lessons/3_Place_ Value/index.html – Students work with place value using whole numbers as well as decimals. This interactive, computer-based lesson includes activities and assessments.

http://www.arcytech.org/java/b10blocks/description.html – Visual representations of base-10 place value and multi-digit operations, a valuable tool for teachers to use in class or for students to use on their own.

http://edweb.sdsu.edu/courses/edtec670/Cardboard/Card/N/NumberClub.html – Instructions for a card game that reinforces place value concepts.
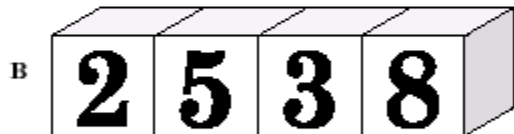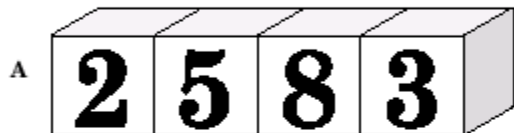
http://www.naturalmath.com/mult/ – A tutorial to help students learn the multiplication facts.

Released SOL test items

1 John made a number with the blocks shown below.

2 5 3 8
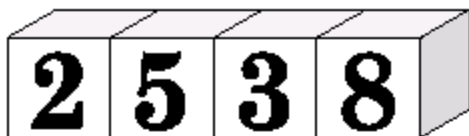
Sonya used the same blocks to make a number LESS THAN John's number. Which could be the number Sonya made?

A 2 5 8 3

B 2 5 3 8

C 2 8 5 3

D 2 3 8 5
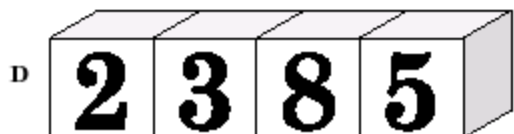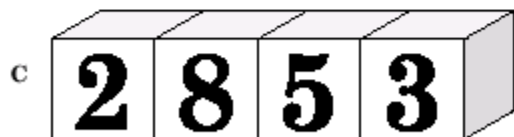
2 **Last February, a card shop sold two hundred thousand, one hundred greeting cards. Which shows this number?**

   F 2,000,100

   G 200,100

   H 20,100

   J 2,100

3 **Harold can use the fact, $3 \times 4 = 12$, to help him solve a related problem. Which of the following could be the problem he is trying to solve?**

   A $\square \div 3 = 4$

   B $\square - 4 = 12$

   C $\square + 3 = 4$

   D $\square - 3 = 4$

9 **A school library has 985,720 books. Which of the following is that number written in words?**

   A Nine hundred eighty-five, seven hundred twenty

   B Nine hundred thousand, seven hundred twenty

   C Nine hundred eighty-five thousand, seven hundred twenty

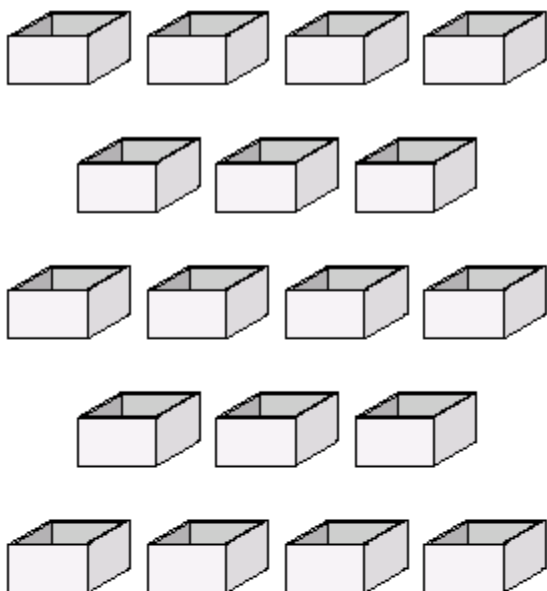   D Nine thousand eighty-five, seven hundred twenty

10

There are 368 buttons in a jar. What is that number rounded to the nearest hundred buttons?

F   300
G   360
H   370
J   400

11

Ben put 5 cookies in each box for the bake sale. How many cookies did he use in all?

A   18
B   45
C   90
D   95

13 A news story reported that 713,298
people watched the play-off game.
What is the value of the 3 in
713,298?

    A 300

    B 3,000

    C 30,000

    D 300,000

16 $7 \times 8 =$

    F 56

    G 54

    H 32

    J 15

18 Sara bought 3 boxes of crackers.
There were 48 crackers in each box.
How many crackers did she buy in
all?

    F 45

    G 51

    H 124

    J 144

20 Lisa learned that the Caribbean Sea
is 8,173 feet deep and the Black Sea
is 3,826 feet deep. How many feet
deeper is the Caribbean Sea than
the Black Sea?

    F 5,753

    G 5,357

    H 4,947

    J 4,347

22 $36 \div 4 =$

    F 6

    G 7

    H 8

    J 9

Organizing Topic Decimals: Representations, Relationships, Operations and Estimation, Addition and Subtraction

Standards of Learning

3.7   The student will read and write decimals expressed as tenths and hundredths, using concrete materials and models.

3.12   The student will add and subtract with decimals expressed as tenths, using concrete materials, pictorial representations, and paper and pencil.

Essential understandings, knowledge, and skills	**Correlation to textbooks and other instructional materials**
The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to	
• Investigate the ten-to-one relationship of the decimal places, using base-10 place-value models.	
• Read and write decimals expressed as tenths, which are represented with base-10 blocks, grid paper, circular fraction pieces, and/or ten-frames.	
• Read and write decimals expressed as hundredths, which are represented with base-10 blocks and/or grid paper.	
• Add and subtract with decimals expressed as tenths, using concrete materials (e.g., grid paper, base-10 materials, and circular regions divided into tenths).	
• Add and subtract with decimal numbers expressed as tenths, using paper and pencil.	

Meter Strip

Reporting category   Measurement, Number and Number Sense, Computation and
                            Estimation

Related Standards of Learning 3.5, 3.7, 3.12, 3.14

Objectives
- Students will develop decimal number sense and make connections between fractions and decimals expressed as tenths or hundredths.
- Students will add and subtract decimals expressed as tenths.
- Students will use actual measuring devices to measure centimeters.

Materials needed
- Two one-meter strips of adding machine tape for each student (premeasured and cut)
- Markers
- Rolls of adding machine tape
- Scissors
- Metric rulers — classroom set

Instructional activity

Part I

1. *Initiating Activity:* Have each student estimate the length of a meter and cut that estimate from a roll of adding machine tape. Have each student decorate his "meter" strip in some manner that he or she will be able to recognize. After the strips have been decorated, have each student tape his or her strip to a tape stripe on the wall. Strips should be taped from the shortest to the longest, in bar graph fashion. Measure the strips with a meter stick to determine the closest estimate. (Now is a good time to talk about how to estimate a meter. A meter is a little bit longer than a yard; it is about the distance from the floor to a doorknob or the width of a twin bed.)

2. After a brief discussion about a meter, distribute a premeasured meter strip to each student.

3. Have the students place the strip horizontally on the desk or table in front of them.

4. On the left end of the meter strip, have the students write 0 and on the right end, have them write 1.00. Discuss briefly with them that they are now holding one unit. (The one unit could be 1 meter or it could represent $1.00.) Model the labeling as you go.

5. Using the metric ruler, have the students divide the unit into ten equal pieces – each 10 centimeters long. (It will be easier for them to visualize if they shade every other decimeter.) Ask, "How many parts are there now in this unit?" (10) Students should recognize that each part is $\frac{1}{10}$ of the whole.

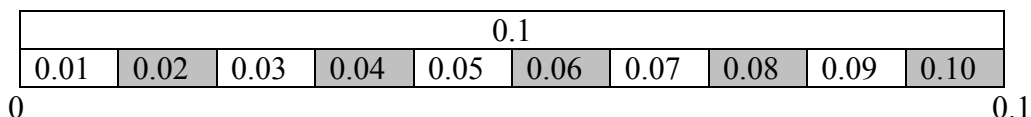   Explain that we have a special way to write the fraction "$\frac{1}{10}$"; we use a decimal and write *0.1*.

6. Have the students label each decimeter as illustrated.

| 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |

0   1
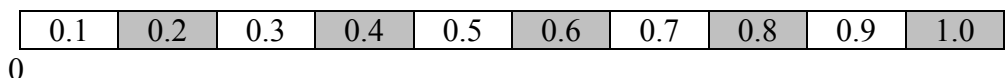
7. Have the students count with you — one-tenth, two-tenths, three-tenths, four-tenths, five-tenths, six-tenths, seven-tenths, eight-tenths, nine-tenths, and ten-tenths. Point out that "ten-tenths" is the same as having one whole.

8. Use the tape to introduce basic addition with decimals. Sample questions could be: "If I have one-tenth of a pizza and I add two-tenths more of the pizza, how much pizza do I have?" Students should be able to see that you have three-tenths of a pizza. Work through several examples where the sum is less than 1.0. As you go through each example, record it on the overhead or chalkboard. Ask the students to look for the pattern in the addition problems. Students should be able to see that the decimals are "lined up" and the sum is "behind the decimal."

9. Have students work with a partner to add sums greater than 1 and the corresponding way to write those sums. (This is a good place to talk about money and its relationship to the meter strip. Each decimeter is the equivalent of a dime. Ten dimes is equal to a dollar; twelve dimes is equal to $1.20.)

10. Subtraction with decimals can be introduced in the same manner. Example: If I have $1.20 (or 12-tenths) and I give you $0.30 (or 3-tenths), how much do I have left? Work through several examples and record each as you go. Again, ask the students to look for the patterns they see.

Part II

1. Distribute another premeasured meter strip of adding machine tape to each student. Have them again divide each strip into decimeters — sections that are each 10 centimeters long. Ask, "How many centimeters are in each section?" (10) Ask, " If we actually divided each section, how many pieces would we have?" (100) (Students should be able to skip count by ten.) Ask, "What would we call each piece?" ($\frac{1}{100}$) It may be easier for them to see if they actually divide and label as shown below.

| | | | | 0.1 | | | | | |
| 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 |

0   0.1

2. Explain that we have a special way to write the fraction $\frac{1}{100}$. We use a decimal and write *0.01*.

    Now is a good time to discuss the relationship of 1 centimeter to 1 cent (a penny). Both are one-hundredth of the whole.

3. In a fashion similar to Part I, introduce the concept of addition of hundredths. Record problems on the overhead or chalkboard. Talk about the need to regroup and exchange 10 hundredths for one-tenth (10 pennies for 1 dime.) Subtraction can also be introduced in a like manner.

Sample assessment

- As students work, circulate and watch carefully as they follow your instructions. Answer any questions, and clarify any procedure that may be giving them trouble.

Follow-up/extension

- Work with money follows this lesson. The strip may need to be labeled with both the faction and decimal name to help students recognize the equivalents. Exchange the meter strip for a $1.00 bill, dimes, and pennies. Play money can be used. Have the students count and make change. (The meter strip can also be used to model the concept of a quarter. Give each student a pre-measured and cut meter strip of adding machine tape. Have them fold it in half and then in half again. Open the strip. There should be four divisions, each representing $\frac{1}{4}$ of the meter. Place this strip next to the strip used in Part I. Students should see that the new piece is bigger than two decimeters. Then use the strip from Part II to see that the new strip is 25 centimeters.)

New Strip — one-fourth of a meter		
0.1	0.2	

↑ ↑ ↑ ↑ ↑
0.01 0.02 0.03 0.04 0.05
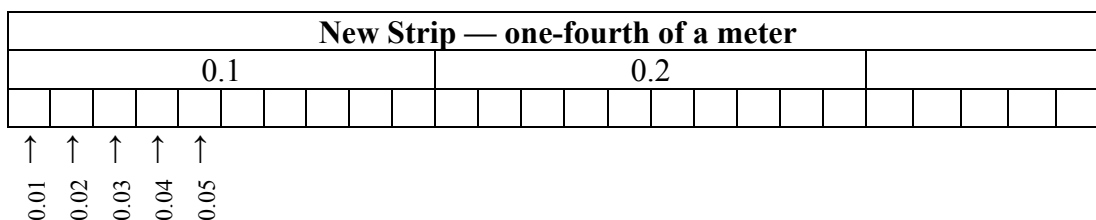
Which Is Closer?

Reporting category   Number and Number Sense, Computation and Estimation
Related Standards of Learning   3.7, 3.12

Objectives

- Students will estimate decimal sums.
- Students will compare decimal sums to the benchmarks 0, 1, and 2.

Materials needed

- "Which Is Closer? Game Cards — Decimals" one copy for each group
- "Which Is Closer? Sum Cards" one copy for each student
- Scissors
- Hundredths strips and hundredths grids
- Calculators

Instructional activity

1. *Initiating Activity:* Pose a sample question, such as "Is the sum of eight tenths and ninety-four hundredths greater than or less than 1?" Ask the students to estimate the answer. Once they have determined that the sum is greater than 1, ask if it is closer to 1 or to 2. Do not introduce rules or algorithms at this point. Instead, encourage students to use decimal manipulatives such as base-10 blocks or hundredths grids and common benchmarks or drawings to explore and reason. Explain that you will ask them to relate their strategies at the end of the lesson.

2. Divide the students into groups of two to four players. Give each player a copy of "Which Is Closer? Sum Cards" and each group a copy of "Which Is Closer? Game Cards — Decimals." Ask the students to cut out all their cards. Assign one player per group the task of calculating the sums for the game.

3. Instruct all players to hold their personal Sum Cards in their hands and to place the group Game Cards face down in a pile in the center of the table. Model the following rules of the game for one round to make sure the students understand how to play:

   a. The first player draws two cards from the Game Cards pile and turns them up in the center of the table. Each player estimates the sum of the two decimals shown on the Game Cards (using decimal manipulatives or ten grids, if necessary) and decides if the sum is closest to 0, 1, or 2. Each student then places the corresponding Sum Card (0, 1, or 2) face up on the table.

   b. After each player has placed a Sum Card on the table, the assigned player uses the calculator or some other method to determine the sum.

   c. The first player who put the correct Sum Card down collects the two Game Cards. If there is a tie, each player gets one Game Card. (If necessary, draw cards from the pile.)

   d. Each player who put down the wrong Sum Card must return one of any Game Cards he or she has collected to the bottom of the pile.

   e. Play continues with the winner of the round turning over two more Game Cards from the pile.

   f. The game ends when all the Game Cards have been used, or there is only one left. The winner is the player with the most Game Cards.

4.   *Closing Activity:* Give each player a chance to describe the estimation strategies that worked best. You may choose to call on each group to describe one of its strategies.

Sample assessment

- As the students play, circulate and listen to any discussions taking place. Ask students to talk about their method of determining which sum to choose.

Which Is Closer? Game Cards — Decimals

0.5	**1.5**	**2**	**0.25**	**0.75**
1.25	**1.75**	**0.33**	**0.67**	**1.33**
0.1	**0.2**	**0.3**	**0.4**	**0.6**
0.7	**0.8**	**0.9**	**1.1**	**1.2**
1.8	**1.9**	**0.125**	**0.375**	**0.625**

Which Is Closer? Sum Cards

0	1	2
0	1	2
0	1	2
0	1	2
0	1	2
0	1	2

The In-Between Game

Reporting category   Number and Number Sense, Computation and Estimation
Related Standards of Learning 3.7, 3.12

Objectives

- Students will use 10-by-10 grids to explore relationships between decimals.
- Students will demonstrate correct ordering of decimals by choosing a number that falls between two decimals.

Materials needed

- Multiple copies of the "Base-10 Grids" handout for each pair of students
- "In-Between Game," one copy for each pair of students
- "In-Between Game" overhead transparency
- Overhead markers

Instructional activity

1. *Initiating Activity:* Hand out multiple copies of base-10 grids to each pair of students. Model on the overhead how to divide a grid into 10 equal-size parts and shade one of the 10 equal-size parts. Write this as "$\frac{1}{10}$" or "0.1." Ask each pair to similarly shade $\frac{2}{10}$ or 0.2 on their first grid. Next ask them to shade $\frac{20}{100}$ or 0.20 on another grid. Have them compare the two shaded decimals. Ask, "Which shaded decimal is the largest?" (They are the same or equivalent.)

2. Have the students use two more base-10 grids to shade the decimals 0.3 and 0.34. Ask which is larger (0.34), and call for responses and reasons. Name the corresponding fractions ($\frac{3}{10}$ and $\frac{34}{100}$).

   Use two more 10 x 10 grids to shade 0.46 and 0.5. Ask which is larger (0.5), and call for explanations. Make sure that the students understand how to compare decimals by place value, and clear up any misconceptions.

3. Give each pair a copy of the "In-Between Game." Explain the rules of the game. (Note: You may need to model a game first on the overhead to get the students started, answering questions as you go.) Allow students to use the base-20 blocks or hundred grids to model the decimals as they play.
   a. The first player chooses a decimal number and writes it on the first row in the first column. The second player chooses a second decimal different from the first (smaller or larger) and writes it on the first row in the third column directly across from the first number. Example:

          0.5   ____   0.7

b. The first player then chooses a decimal number that is "in between" the original two numbers, records this number on the second row in the middle column, and crosses out the smallest (first) number. Example:

| 0.5̶ | ____ | 0.7 |
| ____ | 0.6 | ____ |

c. The first player now writes the two remaining numbers on the third row in the first and third columns, and the game continues. Example:

0̶.5̶	____	0.7
____	0.6	____
0.6	____	0.7

d. The second player now chooses a number "in between" these numbers, and so on for five to ten rounds. Example:

0̶.5̶	____	0.7
____	0.6	____
0̶.6̶	____	0.7
____	0.65	____
0.65	____	0.7

After the students have had the opportunity to play the game on their own, ask several of the pairs to display their games on the overhead for all to see and to share their game plays and strategies.

Sample assessment

- Circulate as the students are playing and listen to the discussions taking place. Answer any questions that may arise.

Follow-up/extension

- As an alternative, this game can be played using fractions, or a combination of fractions and decimals.

Sample resources

http://standards.nctm.org/document/chapter5/numb.htm#bp3 – NCTM Principals and Standards for School Mathematics chapter on the Number and Operations Standard for Grades 3-5.

http://askeric.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Mathematics/Number_Sense/NUS0200.html – an activity in which students arrange themselves into decimal numbers.

The In-Between Game

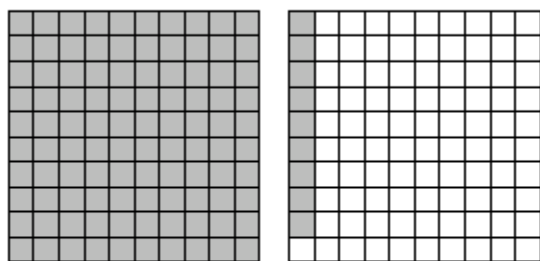| _____ | _____ | _____ |
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.   What was your strategy at the beginning of the game?

2.   Did your strategy change as the game went along? If so, how and why?
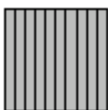
Base-10 Grids
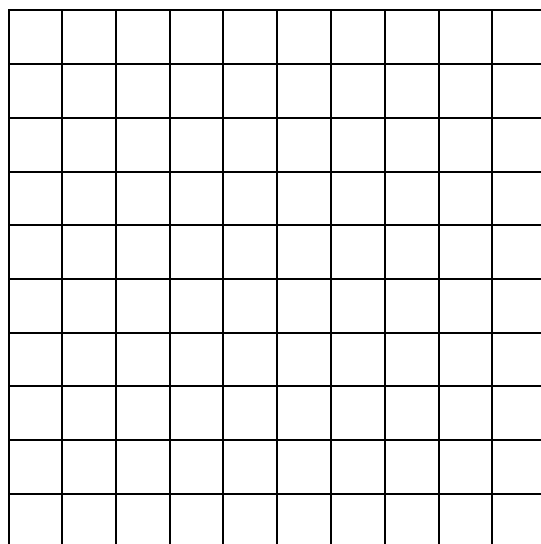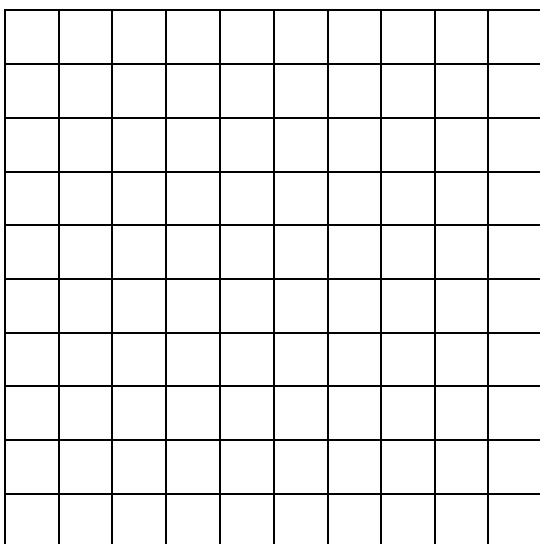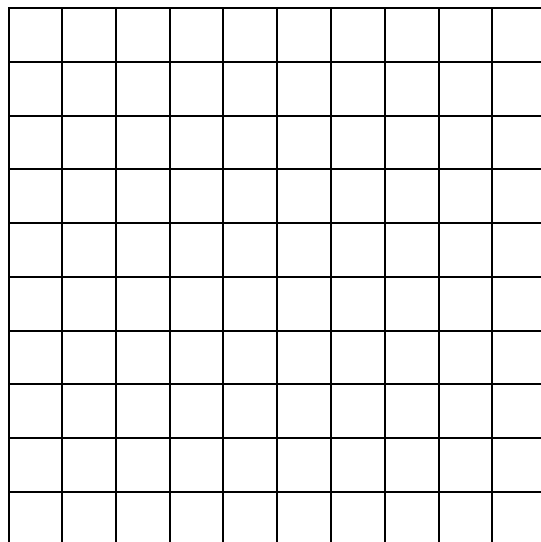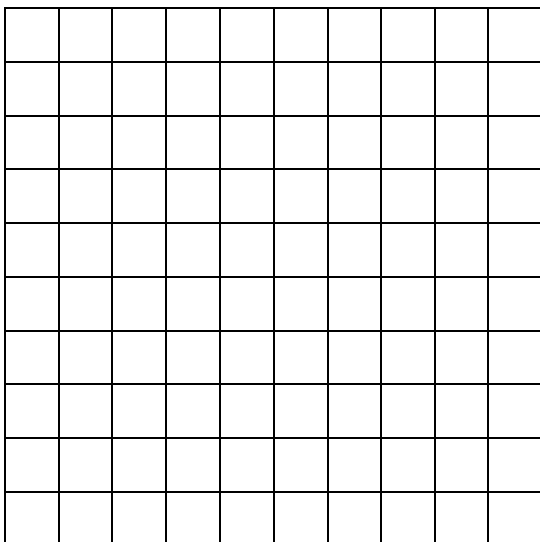
Released SOL test items

8 What number is represented by the shaded part of the figure below?

F 0.19
G 1.09
H 1.19
J 2.09

19 This is one.   This is one-tenth.

What is

+ ... ?
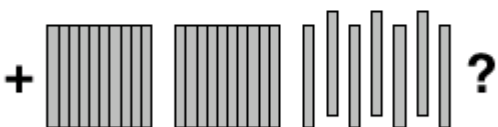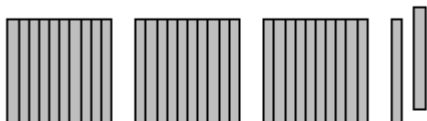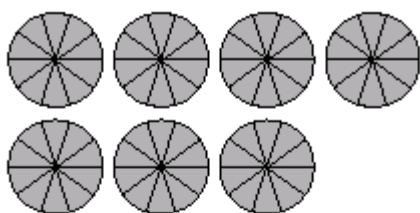
A 1.5
B 3.9
C 5.9
D 9.5

3
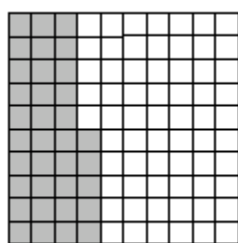
If the large square is 1, what is the shaded part of the large square?
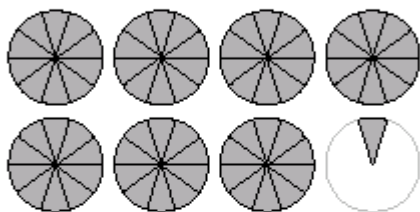
A   0.35

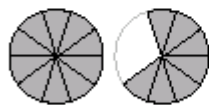B   0.65
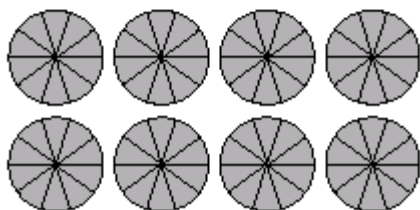
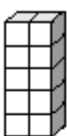C   3.5

D   35

8   Which represents exactly 1.7?

F

G

H

J

21 **This is one.   This is one tenth.**

What is

$$\text{(image: 1 rod + 3 cubes)} + \text{(image: 1 rod + 5 cubes)} \ ?$$

A   2.8
B   3.3
C   3.5
D   8.2

Organizing Topic   Fractions: Representations and Relationships

Standards of Learning

3.5   The student will
     a) divide regions and sets to represent a fraction; and
     b) name and write the fractions represented by a given model (area/region, length/measurement, and set). Fractions (including mixed numbers) will include halves, thirds, fourths, eighths, and tenths.

3.6   The student will compare the numerical value of two fractions having like and unlike denominators, using concrete or pictorial models involving areas/regions, lengths/measurements, and sets.

3.11   The student will add and subtract with proper fractions having like denominators of 10 or less, using concrete materials and pictorial models representing areas/regions, lengths/measurements, and sets.

Essential understandings, knowledge, and skills	Correlation to textbooks and other instructional materials

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- Name and write fractions and mixed numbers represented by drawings or concrete materials for halves, thirds, fourths, eighths, and tenths.

- Represent a given fraction or mixed number, using concrete materials, pictures, and symbols for halves, thirds, fourths, eighths, and tenths. For example, write the symbol for one-fourth, and represent it with concrete materials and pictures.

- Compare the values of two fractions having like denominators where the denominators are 2, 3, 4, 8, or 10, using concrete or pictorial models. Use the terms *greater than, less than*, or *equal to* or symbols >, <, or = to compare their values.

- Compare the values of two unit fractions (a fraction in which the numerator is one), having unlike denominators, where the denominators are 2, 3, 4, 8, or 10, using concrete or pictorial models. Use the terms *greater than, less than*, or *equal to* or symbols >, <, or = to compare their values.

- Compare the values of two fractions having unlike denominators where the denominators are 2, 3, 4, 8, and 10, using concrete or pictorial models. Use the terms *greater than, less than*, or *equal to* or symbols >, <, or = to compare their values.

- Demonstrate a fractional part (halves, thirds, fourths, eighths, and tenths) of a whole, using
  - ° region/area models (e.g., pie pieces, pattern blocks, geoboards, drawings);

- ° set models (e.g., chips, counters, cubes, drawings); and
- ° measurement models (e.g., nonstandard units such as cuisenaire rods, connecting cubes, and drawings).

- Name and write fractions and mixed numbers represented by drawings or concrete materials for halves, thirds, fourths, eighths, and tenths.

- Represent a given fraction or mixed number, using concrete materials, pictures, and symbols, for halves, thirds, fourths, eighths, and tenths. For example, write the symbol for one-fourth and represent it with concrete materials and/or pictures.

- Add and subtract with proper fractions having denominators of 10 or less, using concrete materials and pictorial models representing area/regions (circles, squares, and rectangles), length/measurements (fraction bars and strips), and sets (counters).

Creating Fraction Strips

Reporting category   Number and Number Sense, Computation and Estimation
Related Standards of Learning 3.5, 3.6, 3.11

Objectives

- Students will create their own set of fraction strips by cutting strips into specific parts:

  $1, \dfrac{1}{2}, \dfrac{1}{3}, \dfrac{1}{4}, \dfrac{1}{8}, \dfrac{1}{10}$

- Students will visually compare fractions, using fraction strips.

Materials needed

- Five equal-size strips of different-colored construction paper for each student (9-by-12) paper is recommended; strips should be 12" long and 2" wide)
- Scissors
- Pencils or markers
- Chart paper
- A legal-size, three-hole punched envelope for each student to hold strips for future projects

Note: For easier management, put the set of paper strips, a pair of scissors, and a marker in a plastic storage bag for each student.

Instructional activity

1. *Initiating Activity:* Brainstorm with the students the ideas they have about fractions — what they remember from previous grades or from experiences outside of school. Record their ideas on sticky notes and place them on a sheet of chart paper. (Students may put their initials on the back of the sticky note, and these may be used later for individual assessment of prior knowledge.) Accept all responses. At the end of the activity, students may examine each idea and verify whether the idea is correct or incorrect.

2. Distribute five strips of different-colored construction paper (for ease of identification, this lesson will use red, blue, green, yellow, and purple), a pair of scissors, and a marker to each student. Explain that they will be creating their own set of fraction strips with these materials. As you work through the steps below, model each step with your own strips.

3. Ask students to label the red strip 1.

4. Have the students fold the blue strip in half. Talk about the two equal-size parts, demonstrating by folding that the two parts are congruent. You may need to introduce or talk about the meaning of *congruent* at this point. Have students label each part $\dfrac{1}{2}$ and then cut on the fold. Ask the students how many of the $\dfrac{1}{2}$ strips it will take to cover the 1 strip. Have them place two $\dfrac{1}{2}$ strips on the 1 strip to demonstrate their answer.

5. Model the same procedure for fourths, choosing the green strip. At each step, discuss how many of the $\frac{1}{4}$ strips it takes to cover the 1, and how many of the $\frac{1}{4}$ strips it takes to cover the $\frac{1}{2}$. After modeling each step for the students, have them repeat the step.

6. Model the same procedure for eighths, choosing the yellow strip. At each step, talk about how many of the $\frac{1}{8}$ strips it takes to cover the 1, how many of the $\frac{1}{8}$ strips it takes to cover the $\frac{1}{4}$, and how many of the $\frac{1}{8}$ strips it takes to cover the $\frac{1}{2}$. After modeling each step for the students, have them repeat the step.

7. Model the same procedure for thirds, choosing the purple strip. This step takes a little more practice to fold the strip into three equal-size parts, or students may use a ruler to mark the strip into thirds. At each step, talk about how many of the $\frac{1}{3}$ strips it takes to cover the 1, or whole. Ask how many of the $\frac{1}{3}$ strips it will take to cover the $\frac{1}{2}$. Students will discover that thirds will not cover the half exactly. After modeling each step for the students, have them repeat the step.

8. Ask students to explain how we would model $\frac{1}{10}$ with the strips. Have students share ideas.

9. Have the students write their name on all their fraction strips, place them in their three-hole punched envelope, and store in their binders.

Note: This activity should help the students visualize fractions and begin to conceptualize the relationships between common fractions. The process of folding and cutting, however, is not an exact one, and the handmade strips may lead to incorrect comparisons.

10. *Closing Activity:* Refer back to the sticky notes from the beginning of the activity. Help students reflect on the concepts that were demonstrated in the activity. Ask students to verbalize the concepts learned in this activity, including pictorial representations, if applicable. The concepts should include:
    - A fraction is a way of representing part of a unit whole.
    - A fraction is used to name a part of one thing.
    - Wholes can be broken into equal-size parts, and the parts can be reassembled into wholes.
    - Equal-size parts have special names: *halves, thirds, fourths* or *quarters, eighths,)*.

11. Organize the sticky notes on a wall chart by having the students indicate in which of three columns labeled *Correct, Misconceptions,* and *Need More Information* the ideas should be placed.

Sample assessment

- During the activity, observe students as you walk around the room and check for understanding. At the end of the activity, students may respond to the following prompts in their math journals:

  ○ "What did you notice that was the same when you created the $\frac{1}{2}$ and the $\frac{1}{8}$ strips?"

  ○ "What did you notice that was different when you created the $\frac{1}{2}$ and the $\frac{1}{8}$ strips?"

  ○ To see if students understand the concept that fractions divide areas into equal-size parts, ask, "If you fold your strips to create $\frac{1}{5}$, how do you know they are fifths?" (There should be 5 equal-size parts.)

Follow-up/extension

- These individual strips can be used in a number of activities for fractions. Suggested activities include comparing fractions, finding equivalent fractions, and adding and subtracting fractions.

Something's Fishy

Reporting category   Number and Number Sense, Computation and Estimation
Related Standard of Learning   3.6

Objective

- Students will use an area/region fraction model to find and record equivalent fractions in the context of a game.

Materials needed

- Pattern blocks (except for the square and the rhombus) **or** paper pattern blocks for hexagon, parallelogram, trapezoid, and triangle, and scissors for each pair of students
- A spinner marked with pictures of the pattern blocks for each pair of students
- A paper clip and pencil for each pair of students
- "Something's Fishy Rules of the Game," one copy for each pair of students
- "Something's Fishy Game Board," one copy for each student

Note: For easier management, duplicate the paper pattern blocks on the following colors of construction paper: hexagons – yellow, parallelograms – blue, trapezoids – red, triangles – green. Game boards and spinners will last longer if they are duplicated on tagboard or some other type of heavy paper and laminated. If paper pattern blocks are used, have the students store them in plastic storage bags when finished.

Instructional activity

1. *Initiating Activity:* Brainstorm with the students about how it is possible to share a pizza on one day with three friends and the next day to share with seven friends but still eat the same amount of pizza that you ate the day before. Use the following example to illustrate: "Mike and three friends stopped at a pizza parlor Saturday night and shared a large pizza equally. What does this mean? Yes, they each had the same-size piece, or *equivalent* piece, of pizza. The next day Mike and seven friends stopped at the same pizza parlor for a snack. This time the eight friends shared a large pizza equally among them and then ordered a second large pizza and shared it equally. Did Mike eat more pizza on Saturday or on Sunday? Or did he eat the same amount each day?"

2. Encourage students to draw pizzas to illustrate what Mike and his friends ate each day. Remember: **concrete** to **representational** to **abstract**. To ensure that students fully understand the situation, you may want to give each student three equal-size circles and a pair of scissors and walk them through the process of dividing the first circle into four equal-size parts and then dividing each of the next two circles into eight equal-size parts. Compare Mike's part of Pizza One to what he ate from Pizzas Two and Three. They are equal — i.e., **equivalent fractions.**

3. Extend the concept by having the class play "Something's Fishy." Explain that the class will be divided into pairs of students and the players in each pair will compete against each other. Give each pair some pattern blocks (or the paper-and-scissors alternative), a copy of the game rules, a spinner with paper clip and pencil, and two game boards. Be sure to demonstrate how to use the spinner if students are not familiar with it. Explain that the object of the game is to cover the game board with pattern blocks completely but without overlaps. The first player to do this is the winner.

4. Explain that for every turn, each player spins the spinner and makes one of three choices: 1) take the pattern block indicated and place it anywhere it fits on his/her board; 2) take other blocks that

when fitted together are equivalent to the block indicated and place these anywhere they will fit on the board (the pieces do not have to be placed together but can be placed anywhere separately); or 3) pass and do nothing. *Important:* Once blocks have been selected and placed, they may not be moved.

> Example: A player spins a hexagon but decides to take two triangles and two parallelograms to place on his/her board instead. These four blocks may be placed anywhere on the board; they do not have to be placed together.

5. After the players have played one round of the game, ask them to record equivalent relationships among the blocks. They should consider the hexagon as one "whole" for this purpose.

> Example: A player spins a hexagon but decides to take six triangles instead. The player places the blocks on his/her game board and also records this action:

> 1 hexagon "whole" = 6 triangles; therefore, 1 triangle represents $\frac{1}{6}$ of the whole.

6. After the players have played at least two rounds of the game, discuss the experience. Ask the students to show and describe what they learned about fractional equivalents between and among the pattern blocks. Participants should have noticed that it takes three parallelograms to equal one hexagon; therefore, one parallelogram is equal to one-third of the hexagon "whole." Two parallelograms equal two-thirds. Two triangles, or two-sixths of the "whole," are equal to one parallelogram or one third of the whole.

> 3 parallelograms = 1 hexagon

> 1 parallelogram = $\frac{1}{3}$ of a hexagon

> 2 parallelograms = $\frac{2}{3}$ of a hexagon

> 2 triangles = 1 parallelogram

> 2 triangles = $\frac{2}{6}$ or $\frac{1}{3}$ of a hexagon

> 2 trapezoids = 1 hexagon

> 1 trapezoid = $\frac{1}{2}$ of a hexagon

7. Have the students continue play until each pair has a winner.

8. *Class management:* After play, have the students collect all the pattern blocks and return them to the appropriate containers. Have students store paper pattern blocks in plastic storage bags for future use. Game boards and spinners along with paper clips and pencils should be collectively stored. This will facilitate the use of the game as a math center, a small group activity, or another class activity.

9. *Closing Activity:* Refer to the story at the beginning of the activity about Mike and his friends and their visits to the pizza parlor. Encourage students to explain how Mike was able to eat the same amount of pizza on Sunday that he ate on Saturday, even though he was with a different number of friends each day. Have a student demonstrate the solution to the class, using the circle cutouts from the beginning of the activity and the known amounts of pizza that Mike ate. Have the student show how the amounts are equivalent. Then ask a student to explain the equivalent fractions represented by the pattern blocks used in "Something's Fishy." How do "Something's Fishy" and Mike's story compare? (Both activities contain equivalent fractions, and different combinations may be used to cover the same area.)

Sample assessment

- Observe the students as they play the game, and check for understanding of equivalent values as they choose the pattern blocks. Ask students to show you the variety of ways that they can cover the area of a hexagon when using only trapezoids, triangles, and parallelograms. They should be able to see that it is possible to cover the area of a hexagon with triangles only or trapezoids only. Likewise, they should be able to explain the combinations that can be used, for example, one trapezoid, one parallelogram, and one triangle. Encourage them to show a variety of combinations.

Follow-up/extension

- "Something's Fishy" is an excellent small group activity for those students who complete their work early in class and need an opportunity to either practice equivalent fractions or extend their understanding of fractions.

Something's Fishy Rules of the Game

This is a game for two players. Each player uses his or her own game board, and the players together use a spinner and a set of pattern blocks.

OBJECT OF THE GAME
To be the first player to cover your game board
completely with pattern blocks but without overlaps

---

1.   Take turns spinning the spinner. Use a pencil and paper clip to activate the spinner.

2.   After each spin, make one of these three choices:

   a.   Take the pattern block indicated on the spinner, and place it anywhere it fits on your game board.

   b.   Take other blocks that when fitted together are *equivalent* to the block indicated, and place these anywhere they fit on your game board. They do not have to be placed together.

   c.   Pass and do nothing.

3.   Once blocks have been selected and placed on your board, they may not be moved.

4.   The first player to cover his/her game board completely but without overlaps is the winner.

Be ready to talk about strategies you found useful while playing "Something's Fishy."

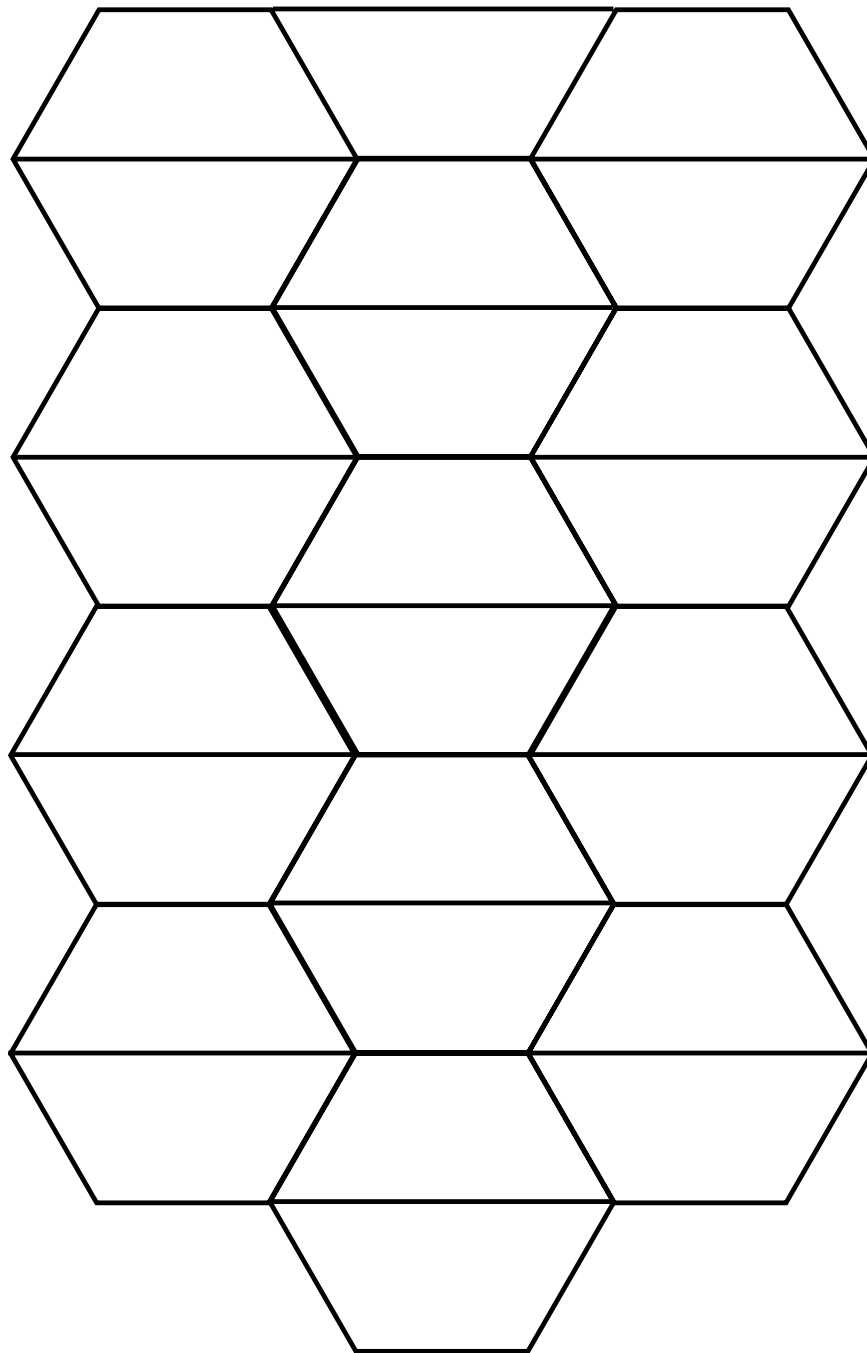# Something's Fishy Spinner
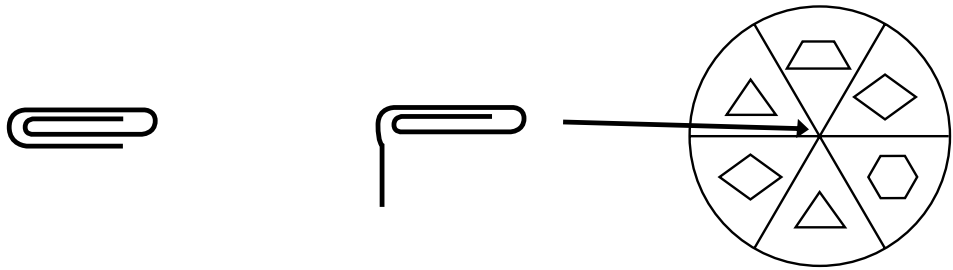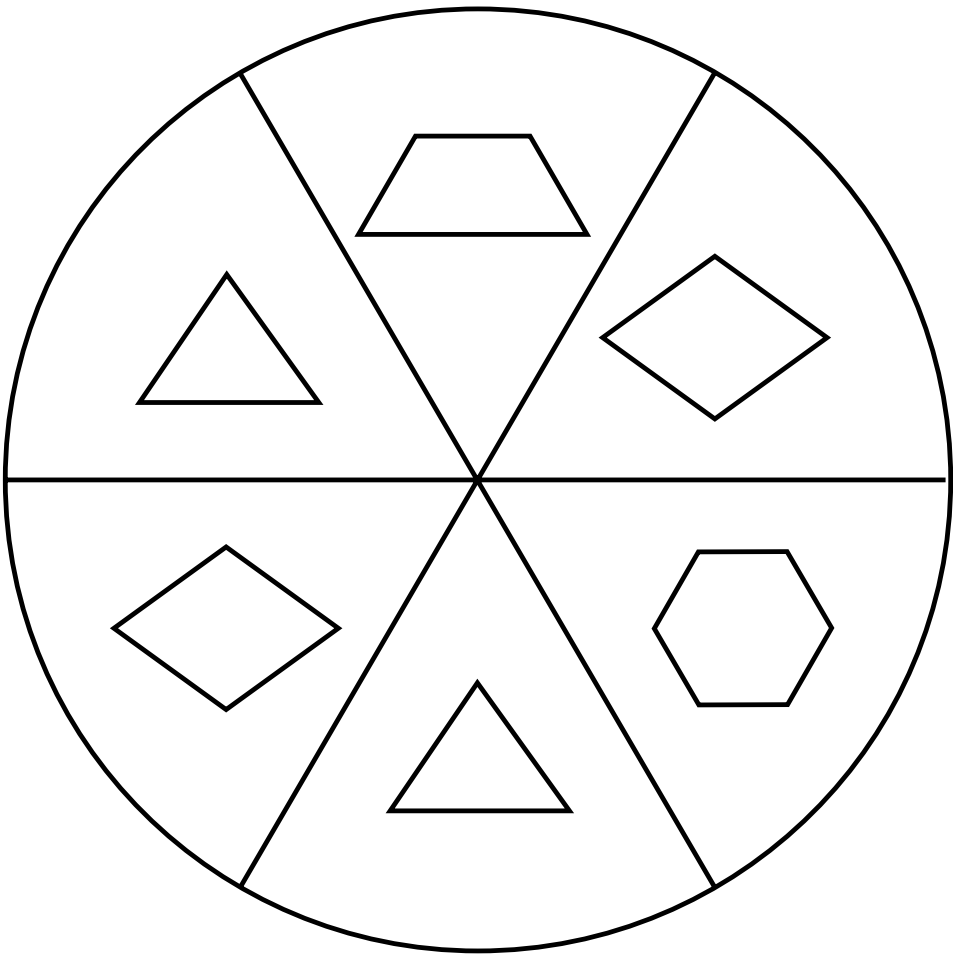
Something's Fishy Game Board
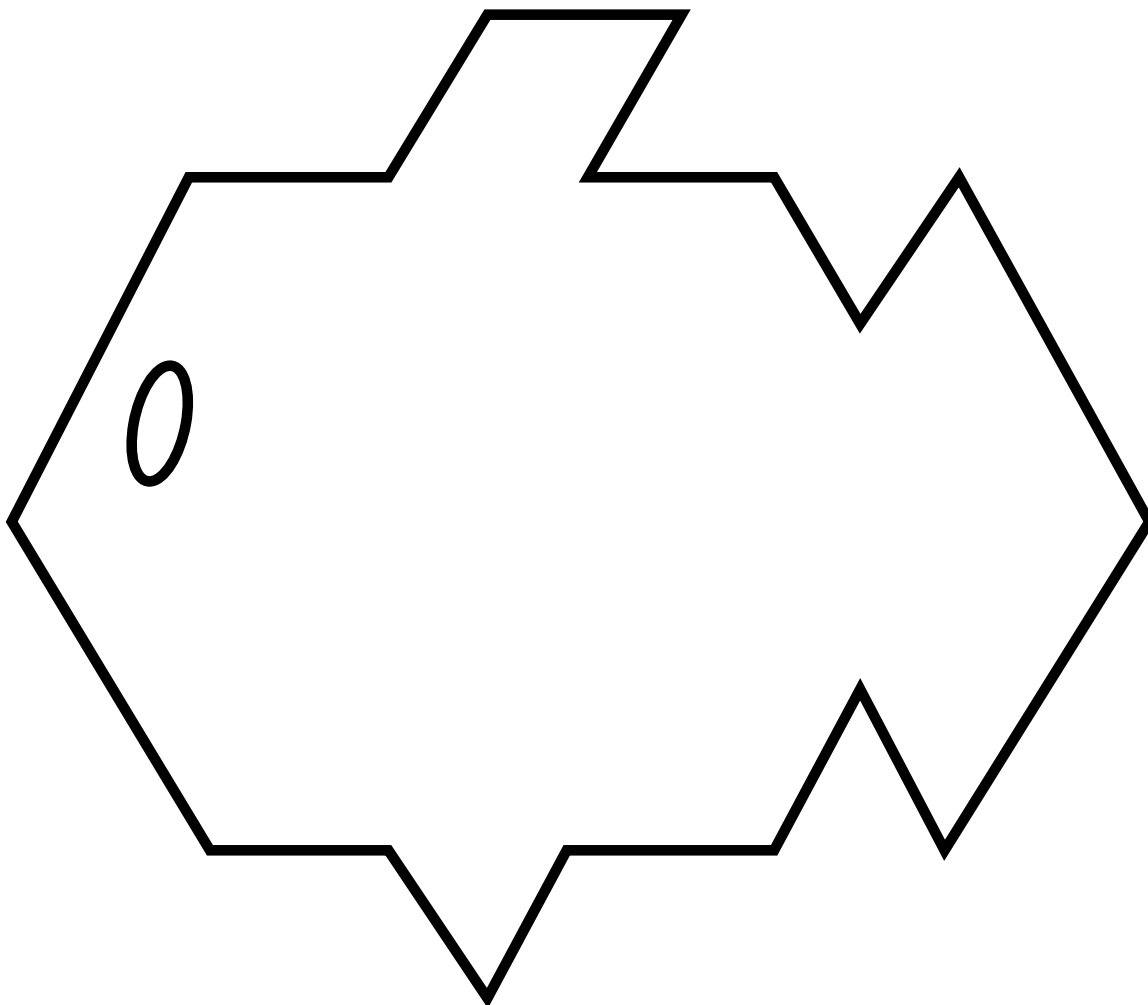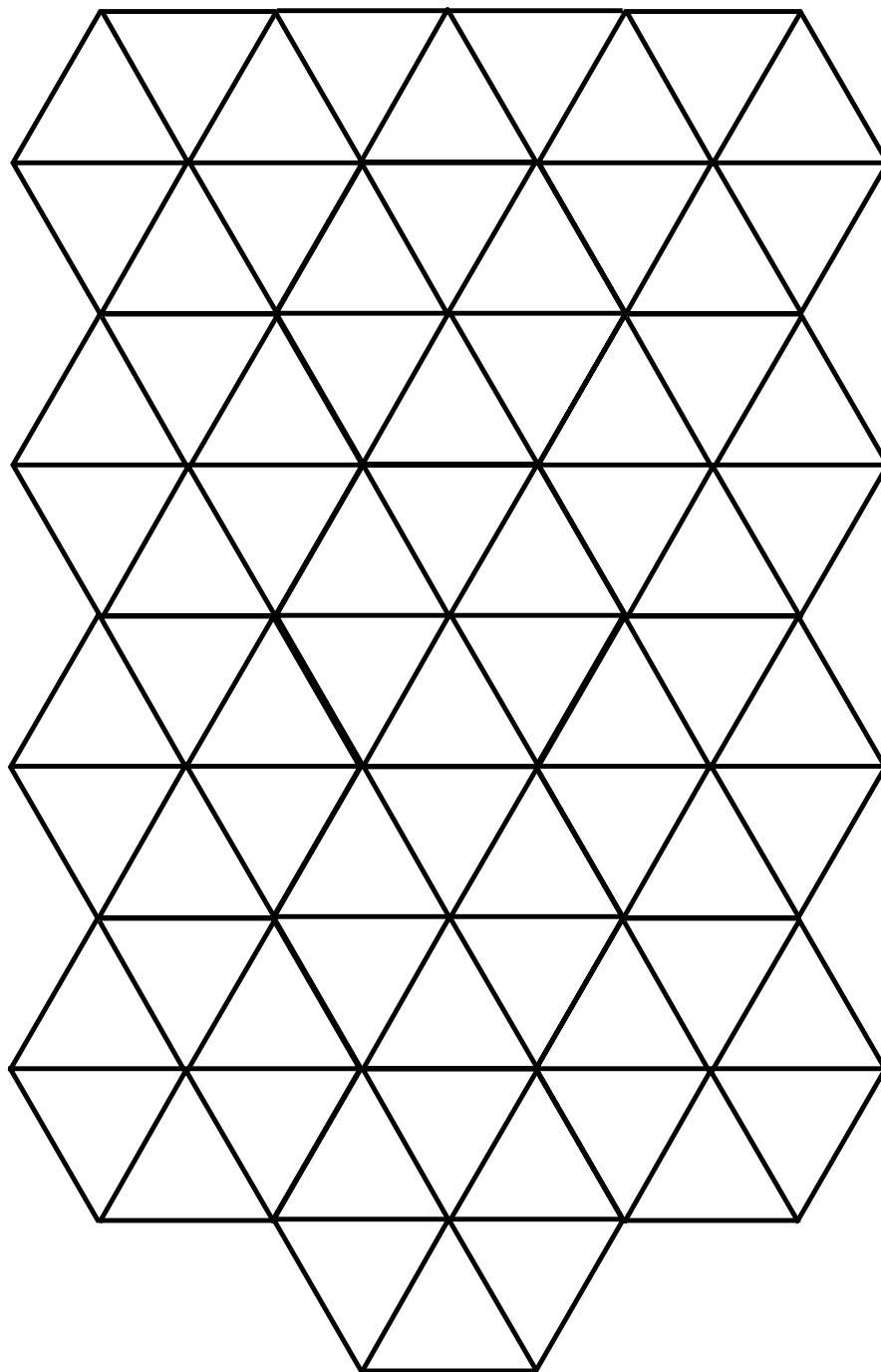
Something's Fishy Hexagon Pattern Blocks
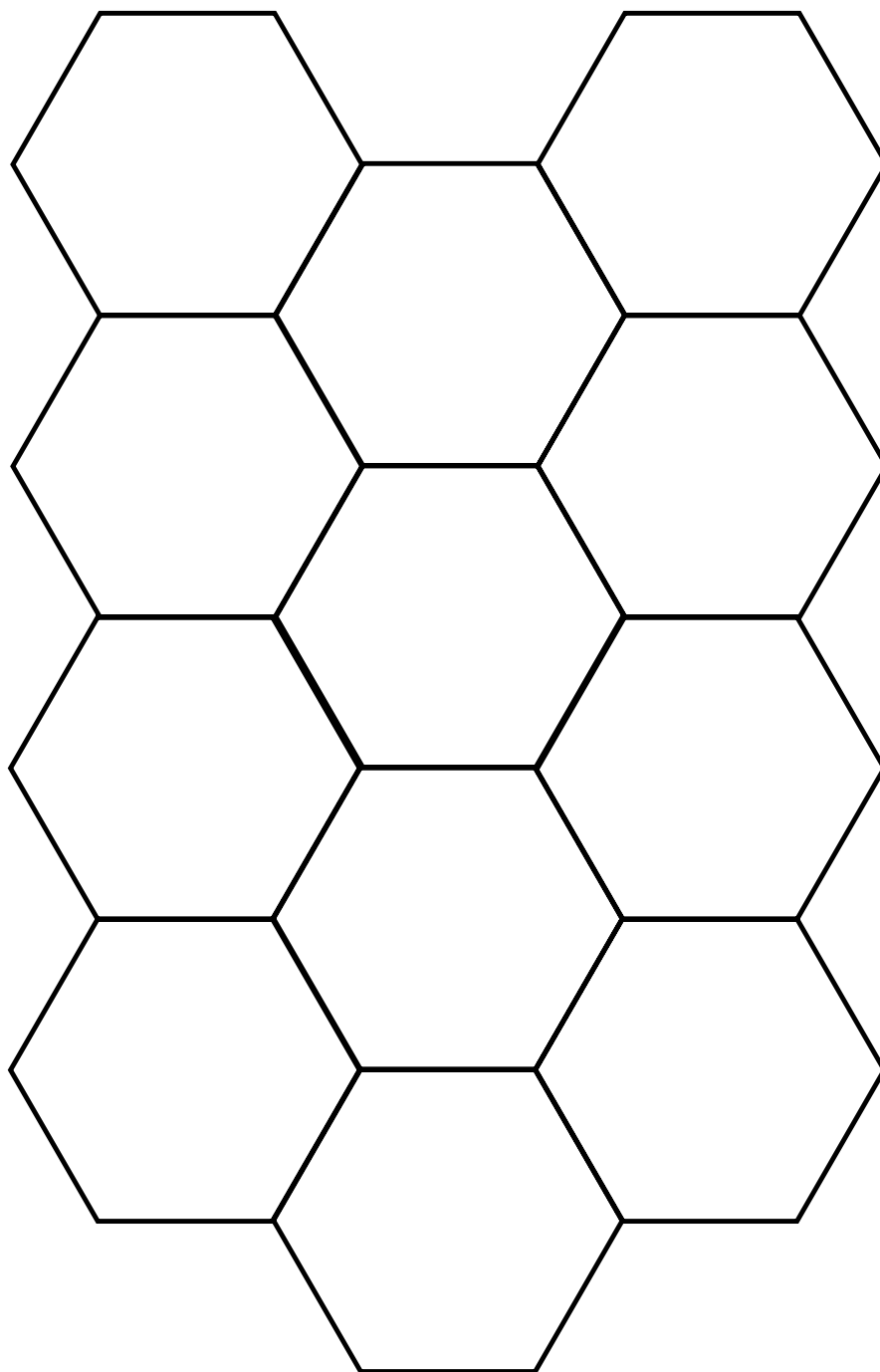
Something's Fishy Parallelogram Pattern Blocks
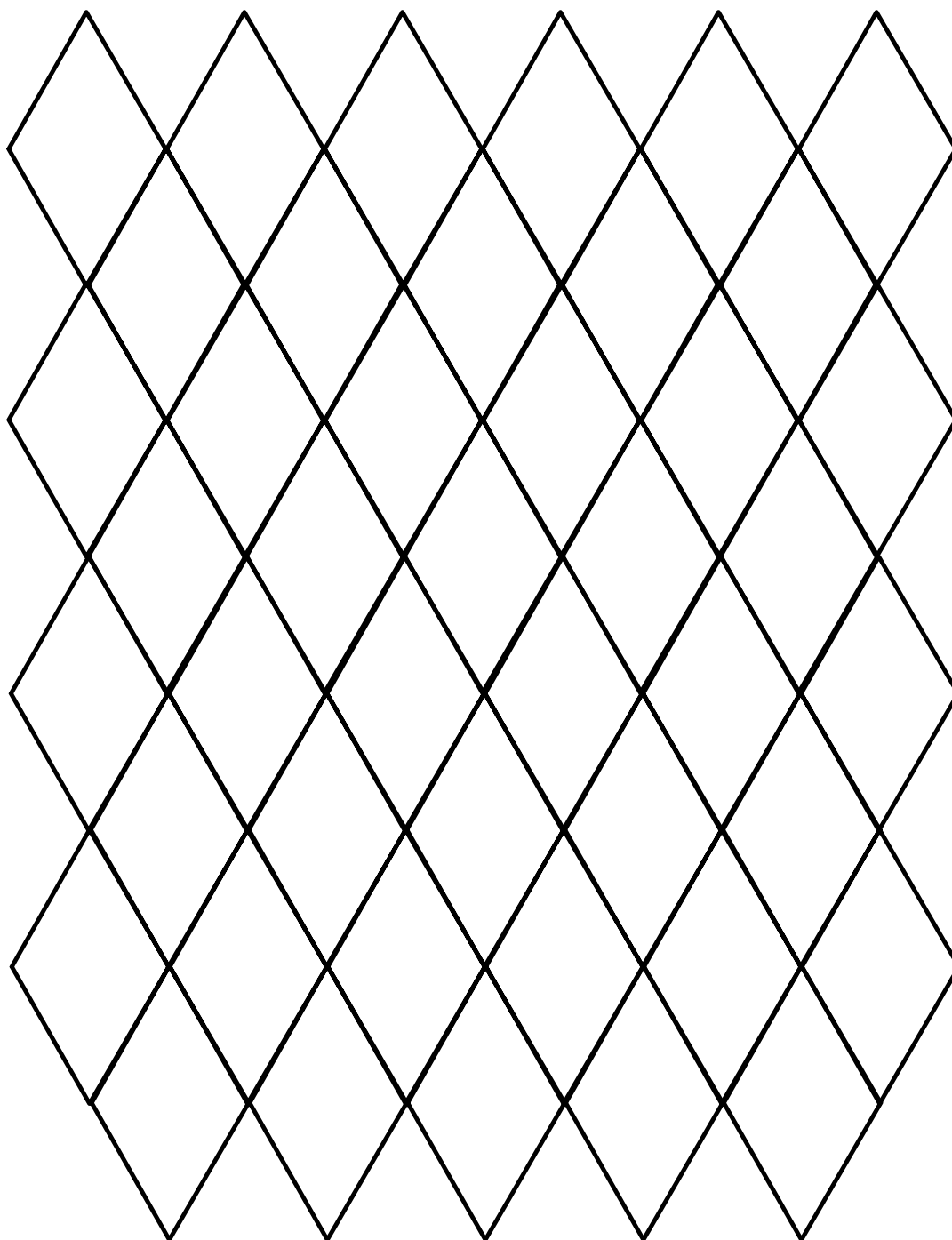
Something's Fishy Trapezoid Pattern Blocks

Something's Fishy Triangle Pattern Blocks

Fraction-Strip Addition

Reporting categories   Number and Number Sense, Computation and Estimation
Related Standards of Learning   3.5, 3.6, 3.11

Objective

- Students will add two fractions, using their set of fraction strips, and interpret the answers in equivalent forms.

Materials needed

- Fraction strips (made in the "Creating Fraction Strips" activity or made from the fraction strip templates on the following pages), one set for each student
- "Fraction Sum Sheet," one copy for each student

Note: Copy each template of fraction strip sheets onto a different color of cardstock or paper. Be sure to precede this activity with the *Creating Fraction Strips* activity (beginning on page 32). Third grade students may experience difficulty with the unlike denominators and need additional examples (step 2c).

Instructional activity

1. *Initiating Activity:* Each student should have a complete set of fraction strips or a complete set of fraction strip sheets, one each for the whole (1 unit), halves, thirds, fourths and eighths. These can be overlapped to work problems and will probably be easier to use in this format. If a student does not understand the overlapping process, the strip sheets may be cut apart.

2. Use the "Fraction Sum Sheet" to model several problems for the class. For example:

   a. Say, "Add the fraction $\frac{1}{2}$ and $\frac{1}{4}$ on your unit strip. What is the sum?" ($\frac{3}{4}$)

   b. Ask, "How many $\frac{1}{8}$ pieces does it take to cover your answer?" (6) Ask, "What is another way to express $\frac{3}{4}$ as a fraction?" ($\frac{6}{8}$)

   c. Say, "Add $\frac{3}{4}$ and $\frac{3}{8}$. What do you think is the sum?" Students may need help at this point, seeing that the answer is more than one. Encourage them to put two whole cards together and continue the same process. They should be able to tell you that the answer is equivalent to nine eighths, or to one whole and one eighth.

3. Give each pair of students a copy of the handout "Fraction Sum Sheet" and several of the following fraction exercises. Alternately, you might give them a handout of all eight problems or write the problems on the board one at a time. Ask them to work with their fraction strips to find the sums and to record the equivalent fractions they used in the process. (See answers below.)

   a. $\frac{1}{3} + \frac{1}{3}$ b. $\frac{3}{8} + \frac{1}{4}$ c. $\frac{5}{8} + \frac{7}{8}$

d. $\dfrac{3}{4} + \dfrac{1}{2}$ e. $\dfrac{1}{8} + \dfrac{1}{2}$ f. $\dfrac{2}{3} + \dfrac{2}{3}$

g. $\dfrac{1}{2} + \dfrac{3}{8}$ h. $\dfrac{1}{2} + \dfrac{5}{8}$

4.   *Closing Activity:* Ask each group to discuss the strategies they used and look for patterns. Write the problem $\dfrac{3}{4} + \dfrac{7}{8}$ on the board or overhead. Ask each student to find the answer and write a short paragraph justifying the answer. Encourage drawings or diagrams. Call for responses from students, or allow each group time to discuss their answers.

Answers to the Fraction Exercises

a. $\dfrac{2}{3}$ b. $\dfrac{5}{8}$ c. $\dfrac{12}{8}$ or $\dfrac{3}{2}$ or $1\dfrac{1}{2}$

d. $\dfrac{5}{4}$ or $1\dfrac{1}{4}$ e. $\dfrac{5}{8}$ f. $\dfrac{4}{3}$ or $1\dfrac{1}{3}$

g. $\dfrac{7}{8}$ h. $\dfrac{9}{8}$ or $1\dfrac{1}{8}$

Fraction Sum Sheet

$$\frac{\square}{\square} = \frac{\square}{\square}$$

+

$$\frac{\square}{\square} = \frac{\square}{\square}$$

Sum

Fraction Strips — One Whole

1
1
1
1
1

Fraction Strips — Halves

$\frac{1}{2}$	$\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{2}$

Fraction Strips — Thirds

$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$

Fraction Strips — Fourths

$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$
$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$
$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$
$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$
$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$	$\dfrac{1}{4}$

Fraction Strips — Eighths

$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$

Four in a Row

Reporting category   Computation and Estimation

Related Standards of Learning 3.5, 3.6, 3.11

Objective

- Students will add and subtract common fractions, using fraction strips.

Materials needed

- Fractions strips (made in the "Fraction Strips" activity), one set for each student
- "Fraction Chart," one copy for each pair of students
- "Four in a Row Game Board," one copy for each pair
- Beans of two colors or other board markers

Instructional activity

1. *Initiating Activity:* Model the game for the class.
2. Let each pair of students decide who goes first. Player 1 chooses two fractions on the "Fraction Chart" that can be added or subtracted to get one of the answers on the "Four in a Row Game Board." Player 1 must first demonstrate the problem with the fraction strips (or another method), after which he or she may cover the answer with a bean or marker.
3. Each fraction may be used only once. Put a bean on each fraction as it is used.
4. Player 2 now takes a turn. Play continues until someone covers four fractions in a row — horizontally, vertically, or diagonally.
5. Have students record their moves, and after the game have a discussion about the strategies they used to point out the mathematics.

Fraction Chart

$\dfrac{7}{8}$	$\dfrac{1}{2}$	$\dfrac{1}{4}$	$\dfrac{1}{3}$
$\dfrac{2}{5}$	$\dfrac{2}{3}$	$\dfrac{3}{4}$	$\dfrac{2}{4}$
$\dfrac{1}{8}$	$\dfrac{5}{8}$	$\dfrac{3}{6}$	$\dfrac{6}{8}$
$\dfrac{3}{5}$	$\dfrac{4}{5}$	$\dfrac{3}{8}$	$\dfrac{1}{5}$
$\dfrac{9}{10}$	$\dfrac{7}{12}$	$\dfrac{3}{10}$	$\dfrac{5}{12}$

Four in a Row Game Board

$\dfrac{1}{4}$	$\dfrac{3}{8}$	$\dfrac{2}{3}$	$\dfrac{1}{2}$
$\dfrac{3}{4}$	$\dfrac{1}{12}$	$\dfrac{7}{8}$	$\dfrac{1}{8}$
$\dfrac{5}{8}$	$\dfrac{1}{12}$	$\dfrac{11}{8}$	$\dfrac{3}{2}$
$\dfrac{13}{10}$	$\dfrac{9}{8}$	$\dfrac{5}{4}$	0

Fraction-Strip Subtraction

Reporting category   Computation and Estimation
Related Standards of Learning 3.5, 3.6, 3.11

Objectives
- Student will subtract fractions, using fraction strips.
- Students will recognize equivalent forms of fractions, using fraction strips.

Materials needed
- Fraction strips
- Set of Fraction Cards

Instructional activity

1. *Initiating Activity:* Give each student a complete set of fraction strips. Hold up the unit (1) strip and ask, "What does this represent?" (One unit or one whole) Ask, "How many fourths make up this unit?" (4) Say, "Place the unit and four fourths from your set of strips in front of you on the desk. If this whole unit represents a candy bar, and I give $\frac{1}{4}$ of it to Sue, how much of the candy bar remains?" ($\frac{3}{4}$) Then ask, "If I give an additional $\frac{1}{4}$ of the candy bar to Joe, how much of the original candy bar will be left for me?" ($\frac{2}{4}$)

2. Once the students understand the process of using fraction strips to subtract from a whole unit, group the students into pairs or small groups to play the game "Take One." Give each group a set of fraction cards. Model the activity for the class, using overhead fraction strips. Start with the unit piece. Subtract $\frac{3}{8}$. Ask for the result. Subtract $\frac{1}{8}$ from that answer. Interpret the answer. Answer any questions that arise.

> **DIRECTIONS FOR THE GAME "TAKE ONE"**
> 1   Begin with the whole unit or two halves. Draw a fraction card from the center of the table and remove the amount shown from the whole or two halves.
> 2. Keep track of what is left with the fraction strips.
> 3. Substitute equivalent fractions as needed.
> 4. Alternate turns, with each student drawing a card and subtracting.
> 5. The first player with a blank board wins.

3. Ask the pairs of students to place on the desk fraction strips to represent $\frac{7}{8}$ and. $\frac{4}{8}$. Ask, "Which is greater?" ($\frac{7}{8}$) Ask them, "How much greater?" Following the previous work with addition of strips, pairs may be able to line up the two fractions one under the other and fit fraction strips to represent the difference. Call on volunteers to model their work. If necessary, model the problem yourself on the overhead with transparent fraction strips to show that the difference is $\frac{3}{8}$.

4. Ask the groups to model the following problems one at a time and record their models by drawing on paper. Have them demonstrate and explain their correct solutions on the overhead projector. Have students create problem situations that match the fraction problems.

   a. $\frac{2}{4} - \frac{1}{4}$ b. $\frac{3}{4} - \frac{1}{4}$

   c. $\frac{7}{8} - \frac{2}{8}$ d. $\frac{6}{8} - \frac{2}{8}$

5. *Closing Activity:* Ask each student to model a solution to the following problem, record a diagram or picture of their model, and write an explanation of their solution: "Brad has $\frac{6}{8}$ of a pound of fudge, and Julie has $\frac{7}{8}$ of a pound of fudge. Together, do they have enough fudge to serve 12 people $\frac{1}{8}$ of a pound of fudge each?" Solutions will vary in appearance, but all students should come to an understanding that Brad and Julie have a total of $\frac{13}{8}$ pounds of fudge – enough to serve 12 people $\frac{1}{8}$ of a pound of fudge each with some left.

Follow-up/extension
- The activities and problems in this activity can be done quite easily with fraction squares or circles, with egg cartons, or with other fraction manipulatives.
- The use of a ruler is important in science for making measurements. This activity could be tied to subtracting lengths – given in halves, fourths, and eighths of an inch or tenths of a centimeter – from a starting length. For example, groups could be given a yard of adding machine tape and asked to cut as many $4\frac{1}{2}$-inch lengths as possible from it, recording the result at each step. This would reinforce subtraction as well as set the stage for division. Each group could cut lengths of a different size and make comparisons.

Sample resources

Thinking Rationally about Fractions, Decimals, and Percent – lesson plans available from VDOE at
http://www.pen.k12.va.us/VDOE/Instruction/Math/FractionsDecimalsPercent.pdf

http://math.rice.edu/~lanius/Patterns/ – Students use pattern blocks to investigate and build relations
among fractions.

http://mathforum.org/paths/fractions/e.fraclessons.html – Extensive list of lesson plans and software
related to fraction concepts.

http://www.col-ed.org/cur/math/math19.txt – Students construct words based on the fractional parts of
other words in order to create a clue for a hidden candy bar.

http://mathcentral.uregina.ca/RR/database/RR.09.95/hanson4.html –This lesson plan uses pattern blocks
to help students understand fractions and operations on fractions.

http://www.teachnet.com/lesson/math/fractioncity.html – This lesson provides instructions for an in-
class activity in which students compare fractional parts

Fraction Cards

$\dfrac{2}{2}$	$\dfrac{4}{4}$	$\dfrac{1}{4}$	$\dfrac{8}{8}$
$\dfrac{0}{2}$	$\dfrac{3}{8}$	$\dfrac{1}{8}$	$\dfrac{0}{4}$
$\dfrac{0}{8}$	$\dfrac{7}{8}$	$\dfrac{3}{4}$	$\dfrac{5}{8}$
1	$\dfrac{1}{2}$		

Released SOL test items
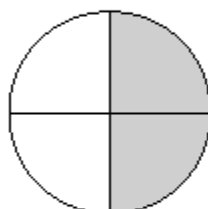
4

1

3

2

4
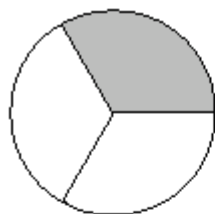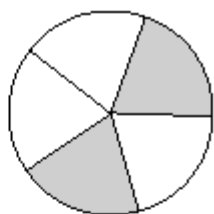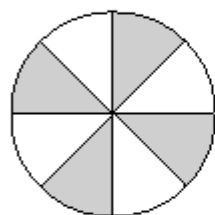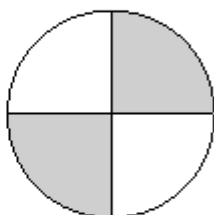
Which two figures have an equal fraction shaded?

F   1 and 2

G   1 and 3

H   2 and 4

J   3 and 4

6   What fraction of the group of eggs is cracked?
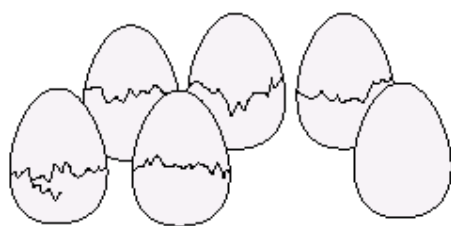
F $\dfrac{1}{6}$

G $\dfrac{5}{6}$

H $\dfrac{5}{1}$

J $\dfrac{6}{5}$

7 Each figure below is shaded to represent a fraction. Which pair of figures makes a statement that is true?

A   <

B   <

C   <

D   <
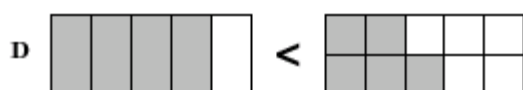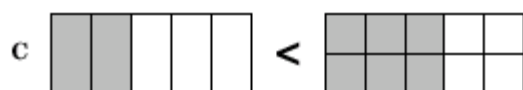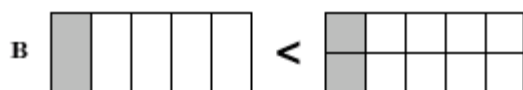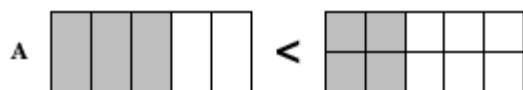
17 This is a whole.

How much is

 — ?

A $\dfrac{1}{4}$

B $\dfrac{4}{5}$

C $\dfrac{6}{4}$

D $\dfrac{4}{6}$

23 This is a whole.
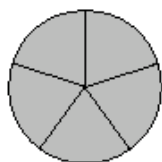
What is

 + **?**
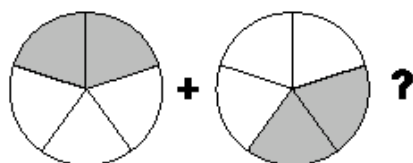
A $\dfrac{1}{5}$

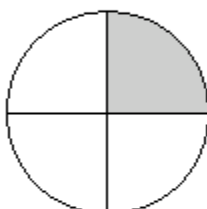B $\dfrac{4}{5}$

C $\dfrac{5}{4}$

D $\dfrac{9}{5}$

2

1

3

2

4
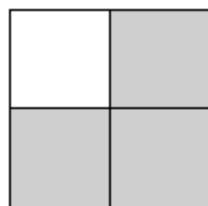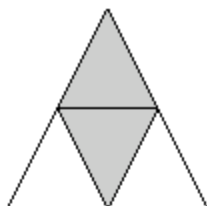
Which two figures have an equivalent fraction shaded?

F 1 and 2
G 2 and 3
H 3 and 4
J 1 and 4

4 **What fraction of the group of bones is in the bowl?**

F $\frac{4}{6}$

G $\frac{4}{10}$
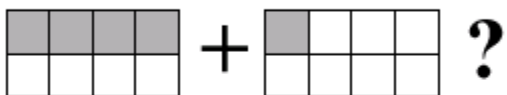
H $\frac{6}{10}$

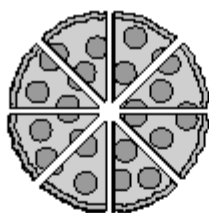J $\frac{1}{4}$

14 **This is a whole.**

What is

 ?

F $\frac{1}{4}$

G $\frac{3}{8}$

H $\frac{5}{8}$

J $\frac{5}{1}$

12

Lisa ate $\frac{1}{8}$ of the pizza. How much of the pizza did she eat?

F

G

H

J

Organizing Topic   Measurement: Money, Length, Weight/Mass, Volume (Liquid), Temperature, Time

See also "Meter Strip" activity in Decimals Unit

Standards of Learning

3.13   The student will determine by counting the value of a collection of bills and coins whose total value is $5.00 or less, compare the value of the coins or bills, and make change.

3.14   The student will estimate and then use actual measuring devices with metric and U.S. Customary units to measure
    a)   length — inches, feet, yards, centimeters, and meters;
    b)   liquid volume — cups, pints, quarts, gallons, and liters; and
    c)   weight/mass — ounces, pounds, grams, and kilograms.

3.15   The student will tell time to the nearest five-minute interval and to the nearest minute, using analog and digital clocks.

3.16   The student will identify equivalent periods of time, including relationships among days, months, and years, as well as minutes and hours.

3.17   The student will read temperature to the nearest degree from a Celsius thermometer and a Fahrenheit thermometer. Real thermometers and physical models of thermometers will be used.

Essential understandings, knowledge, and skills	**Correlation to textbooks and other instructional materials**
The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to	
• Count the value of collections of coins and bills up to $5.00.	_____
• Compare the values of two sets of coins or bills, up to $5.00, using the terms *greater than, less than*, and *equal to*.	_____
• Make change from $5.00 or less.	_____
• Identify and use the following units of length: centimeters, meters, inches, feet, and yards.	_____
• Identify and use the following units of liquid volume: cups, pints, quarts, gallons, and liters.	_____
• Identify and use the following units of weight/mass: ounces, pounds, grams, and kilograms.	_____
• Estimate and then measure lengths of objects to the nearest centimeter and meter and the nearest inch, foot, and yard.	_____
• Estimate and then measure the weight/mass of objects to the nearest ounce and pound and the nearest gram and kilogram.	_____
• Estimate and then measure liquid volume to the nearest cup, pint, quart, gallon, and liter.	_____

- Tell time to the hour, half-hour, quarter-hour, nearest five-minute interval, and nearest minute, using analog and digital clocks.

  _____

- Match the times shown on analog and digital clocks to written times.

  _____

- Identify equivalent relationships observed in a calendar, including the number of days in a given month, the number of days in a week, the number of days in a year, and the number of months in a year.

  _____

- Identify the number of minutes in an hour and the number of hours in a day.

  _____

- Read temperature to the nearest degree from real Celsius and Fahrenheit thermometers and from physical models (including pictorial representations) of such thermometers.

  _____

Money Counts

Reporting category   Measurement, Computation and Estimation

Overview   The use of book club fliers offers many opportunities for students to count, compare, and make change from $5.00.

Related Standard of Learning   3.13

Objectives

- The student will count the value of a collection of coins and bills
- The student will compare the values of two sets of coins and bill, up to $5.00, using the terms *greater than*, *less than*, and *equal to*.
- The student will make change from $5.00 or less.

Materials needed

- Fliers or catalogues from book stores with ads for children's books, or monthly book club fliers
- Various bagged collections of coins and dollar bills (play money) to equal $5.00, one bag for every two students. Place an alphabet letter label on each bag and make a key indicating the amounts in each bag.
- "Money Counts," one copy for each student
- Overhead coins and bills

Instructional activity

1. Explain to the students that the class has been given a special present, a gift certificate to purchase $125.00 worth of children's books from the book club. (Usually, a teacher accumulates points that can be redeemed for books. Convert the points to a dollar value for this activity.) Prior to selecting and purchasing one of the books, students will need to practice their money-counting skills. Explain that they will practice with bags of play money. Demonstrate with the overhead coins and bills one combination that equals $5.00, e.g., 3 one-dollar bills, 4 quarters, 5 dimes, 9 nickels, and 5 pennies. Model how to count the value of the money starting with the largest denomination of bill and coin. Continue to count, using the coins of lesser value until all the money has been counted. Practice with another amount of money, modeling again how to count on from the largest bill to the smallest coin. Remind the students that they can use their skip-counting skills as they count the coins.

2. Distribute the bags of money to each pair of students. Explain that each bag contains a specific amount of money, equal to or less than $5.00. Once the student has identified the amount of money in the bag, a partner will count it again to verify the amount. Have students record the letter label of the bag and the amount of money in the bag on their recording sheet.

3. Have students pass the bags in an organized manner to the next set of partners. Students practice the counting again and verify the count, recording the letter label of the bag and the amount of money on their recording sheet. Continue passing the bags until students have had a chance to practice with at least five bags of money.

4. For the second part of the lesson, have students think of various combinations of coins and bills that are equal to $5.00. Ask students to suggest one combination of coins and bills that would be equal to $5.00. Record the suggested combination on a chart similar to the one on the student

recording sheet. Have students work with a partner to create nine different combinations of coins and bills that would equal $5.00.

5. For the last part of the lesson, model with students the process of giving change from $5.00. A variety of skills can be used to determine the change after a purchase, including

- counting on, i.e., starting with the amount to be paid (purchase price), counting forward to the next dollar, and then counting forward by dollar bills to reach the amount from which to make change
- mentally calculating the difference
- using coins and bills.

Explain to students that they will receive the book flyers from which to choose the book they wish to purchase. The only criterion for the purchase is that it must cost $5.00 or less.

6. Distribute the fliers and have students select a book of their choice that is less than or equal to $5.00. Each student works with a partner and practices figuring out the change that he or she would receive after purchasing the selected book. Have students record the book title, cost, and change from $5.00 on the recording sheet and then use the bag of money to count out a combination of coins and bills equal to the value of the book. Each student will write a number sentence about the value of his or her coins and bills in comparison to the partner's coins and bills.

Sample assessment

- Circulate during the counting of the coins and bills to verify that students are using the correct strategies, e.g., counting on, skip-counting. Note who is having difficulty identifying the coins, bills, value, counting, writing the value and/or comparing amounts. Give help as necessary. Collect the recording sheets as an assessment.

Money Counts

Part I: Money Bags

Bag Label	Total Value of Coins and Bills

Part II: Counting $5.00 Worth of Coins and Bills

How Many?	Pennies	Nickels	Dimes	Quarters	Half-dollars	Bills

Part III Buying Books

The title of my book is _____.
The cost of my book is _____.
The change that I would get from $5.00 after buying my book is _____.

The coins and bills that equal the cost of my book are:

Pennies	Nickels	Dimes	Quarters	Half-dollars	Bills	Total Value

My partner's coins and bills that equal the cost of his or her book are:

Pennies	Nickels	Dimes	Quarters	Half-dollars	Bills	Total Value

Whose book costs more, yours or your partner's? _____

Write a sentence that compares the two amounts of money, using the terms *greater than, less than,* or *equal to*.

_____

Getting to Know You

Reporting category   Measurement

Overview   Students decide which linear measurement would be appropriate to measure various parts of their bodies, measure, and record the measurement.

Related Standard of Learning 3.14a

Objectives

- The student will identify an appropriate unit of measure.
- The student will estimate and then measure various parts of the body using an appropriate measuring tool.

Materials

Prior to the lesson, ask students to bring in a measuring tool from home that they can use to measure length. Have available in class:

- Measuring tapes
- Inch rulers
- Yardsticks
- A carpenter's ruler (retracting tape)
- Centimeter tape
- Meter stick
- Trundle wheel
- "Getting to Know You" recording sheet, one copy for each student

Instructional activity

1. Discuss with students the various measuring tools they brought from home. Ask them to describe situations where they or others have used these tools. Explain to students that they will be using the tools or similar tools to measure various parts of their bodies. Begin with a demonstration of the distance around the head. Ask students which of the tools would be appropriate to use. Show students that both a standard measuring tape with inches and a centimeter tape can be used. Demonstrate with one student how to take the measure and how to read the tape. Record the measurements on the chalkboard.

2. Distribute copies of the recording sheet. Explain to students that they are welcome to use the tools they brought from home or the tools that you have available to take the measurements indicated on the recording sheet. Review each item, and ask for suggested tools to use. Demonstrate how to use a piece of yarn to take an indirect measurement if a tool is not available. For example, students can use a piece of yarn cut to the length of their bodies and then take the yarn and measure it against a yardstick or meterstick. They could also use the trundle wheel and measure the length of the yarn. Demonstrate how to use the trundle wheel.

3. Have students work with a partner to assist in taking the measurements. Circulate and offer assistance as needed.

4. When students have completed the recording of the measurements, have them write in their journal about the two types of measurements they used. Ask them to compare the metric measurement with the U.S. customary measurement. How were the two alike and how were they different?

Sample assessment

- Assess student skills by observation. Use the recording sheet as an assessment as well as the journal entry.

Getting to Know You

Body Part To Be Measured	U. S. Customary Measurement	Metric Measurement
Around Head		
Arm Span (arms extended — fingertip of one hand to fingertip of the other hand)		
Length of longest finger		
Length of foot		
Width of fingernail		
Width of smile		
Length of body (top of head to bottom of foot)		

How Much Does It Hold?

Reporting category   Measurement

Overview   Students estimate and then measure the capacity of various containers. Students use cups, pints, quarts, gallons, and liter containers to determine measurements.

Related Standard of Learning   3.14b

Objectives

- The student will identify units of liquid volume.
- The student will use units of liquid volume: cups, pints, quarts, gallons, and liters.
- The student will estimate and measure units of liquid volume to the nearest cup, pint, quart, gallon, or liter.

Materials

Prior to the lesson, have students bring nonbreakable clear containers from home that could be used to hold water, e.g., peanut butter jars. Have available in class:

- Measuring cups
- Pint containers with labels removed
- Quart containers with labels removed
- Gallon containers with labels removed
- Graduated cylinders that show liters
- Liter containers with labels removed
- Rice or water
- "How Much Does It Hold?" recording sheet, one copy for each student

Instructional activity

1. Explain to students that they will be estimating the capacity of a jar, in other words, how much liquid it will hold. Show students a 1-cup measuring cup and tell them the amount of water it will hold. Also show them a larger measuring cup (2-cup, or 8-cup if available). Ask students to estimate how much water each of these measuring cups would hold. Follow the same process with a pint container, a quart container, and a gallon container. Model the different relationships between the various containers. Allow students to assist you in using the water to verify the relationships. As each relationship is established, e.g., two cups in a pint, record it on the board.

2. Have each student estimate the volume of his or her container and record the estimate on the recording sheet. Then, have each student use measuring cups to measure how much water or rice the container holds. Explain to students that they will use their containers as a measuring devices for future use. Give each student a strip of masking tape to place on the outside of the container. As the student pours each cup of water into their container, he or she records the level on the measuring tape and indicates the number of cups.

3. On the following day, place various containers and rice or water in stations and have students use their calibrated jars to determine the volume of different shaped containers. Have them label their individual recording sheets with the station label and work with a partner at each station. First they will record their estimates of the volume. Then they will determine the actual volume of the containers and record the amount.

4. At the end of the session, have students write in their journals about the process of measuring the liquid volume capacity of a container.

5. This lesson plan can be adapted for use with the metric measure of liquid volume, the liter. Third graders are exposed to milliliters in science lessons and are very familiar with two-liter bottles. Graduated cylinders can be used as measuring tools.

Sample assessment

- Assess student skills by observation. The recording sheet and journal entry can also be used for assessment purposes. Allow time for students to compare their results to a partner's and talk about how they are the same or different. Have them consider the shape of the measuring cup (their container) and that of their partner.

How Much Does It Hold?

I estimate that my container holds **_____** **cup(s).**

My container actually holds **_____cup(s).**

How much does each container hold?

Station Label	Estimated Volume	Actual Volume

How Heavy Is It?

Reporting category   Measurement

Overview   Students estimate and weigh a scoop of various materials and record the mass in grams.

Related Standard of Learning   3.14c

Objectives

- The student will estimate the mass of a scoop of five different materials.
- The student will weigh the materials, using a balance scale and record the mass in grams.

Materials

- Balance scale for each group of four students
- Gram weights in various units: 1 gram, 5 grams, 10 grams, 20 grams
- 5 zip closure bags per group containing measured scoops of rice, raisins, peanuts, sand, and jelly beans
- One sample bag of a measured scoop of dried beans
- "How Heavy Is It?" recording sheet, one copy for each student

Instructional activity

1. Explain to students that they will be determining in their groups whether one scoop of different items weighs the same. Show students a sample scoop of each material. Ask students to estimate the weight of each material and record on their recording sheets. Remind students that a paper clip weighs about 1 gram and a nickel weighs about 5 grams.

2. Once students have recorded their estimates, explain that they will be weighing the various bags of items, using a balance scale. Model for students how to use the balance scale with a sample bag containing a measured scoop of dried beans. Have students predict what will happen when the bag of beans is placed in one pan of the balance scale. Model the process by placing the bag in the pan. Ask students if they can tell how much the bag of beans weighs. (Most students are familiar with a bathroom scale or a scale in a grocery store that will indicate the weight with digital or dial measures.) Explain that in order to find out how much the bag weighs, they must place gram weights in the opposite pan until the pans balance, at which time the indicator will point to the center. Demonstrate how to place the weights in the pan, starting with the largest weight and noting if it balances. Continue to add weights, using the next size smaller until the pans balance. Then count the total number of weights in the pan to find the weight of the item, starting with the largest weight and counting on.

3. Distribute the bags of materials and explain that students will work in groups to weigh the bags of materials. Ask the students to record the weight in grams on the recording sheets. After the weights have all been recorded, have students order the items from most heavy to least heavy and record.

4. After all students have completed the task, ask students to write in their mathematics journals about the process of weighing items using a balance scale. Have them explain how it is different from using a bathroom scale or scale in a grocery store.

Sample assessment

- Circulate in the classroom as students are weighing materials. Note students who are having difficulty using the balance scale, counting the values of the weights, or recording the total value. Assist as needed.

Follow-up/extension

- The same lesson can be used for ounces and pounds with modifications to the materials and recording sheet. Students need to be familiar with both types of measures and scales.

How Heavy Is It?

Fill in the chart with the estimated and actual weighs of a scoop of the items listed in the chart:

Item	Estimated Weight (in grams)	Actual Weight (in grams)
Jelly Beans		
Rice		
Sand		
Peanuts		
Raisins		

Order the items from most heavy to least heavy:

Most heavy _____

                        _____

                        _____

                        _____

Least heavy _____

                        _____

                        _____

                        _____

It's About Time

Reporting category   Measurement, Number and Number Sense, Computation and Estimation

Related Standards of Learning 3.15, 3.16

Objectives

- Students will explore the elements of a clock and explain their functions.
- Students will tell time to the nearest hour, half-hour, five-minute interval, and to the nearest minute.

Materials needed

- Paper plates
- Brad fasteners
- Tag board minute and hour hand
- Stop watch
- 'Time Concentration' cards
- "Paper Plate Clock Pattern," one for each student

Instructional activity

Part I: To the hour

1. Introduce a number line that contains the numerals one through twelve. Bend the number line into a circle to resemble a clock face. Provide a worksheet with a large circle. Ask the students to place the numerals inside the circle to make a clock face. According to the ability of the group, it may be necessary to place some marks on the circle to facilitate spacing the numbers.

2. Review with the group that the minute hand is the longer hand and the hour hand is the shorter hand. Remind the group that when the hour hand moves from one number to the next, one hour has passed. Ask, "What can you do in an hour?" Record answers on the overhead or chalkboard. Have the group select one or two suggestions and check the accuracy of their predictions.

3. Remind the group that when the minute hand moves from one tick mark to the next, one minute has passed. Ask, "How long is a minute?" Have the students place their heads on their desks with eyes closed. Explain that you are going to time one minute. When they think a minute has passed, they are to raise their hand. Start timing and observe as students raise their hand. Tell students that you will put their hands back down if they are too early. Clap your hands at the end of a minute. Have the students watch as the second hand goes around the clock once. Challenge them to try again to guess when the minute is up.

4. Ask, "What can you do in a minute?" Record answers on the overhead or chalkboard. Have the group select one or two suggestions and check the accuracy of their predictions.

5. Write times to the hour from one o'clock to 12 o'clock on index cards and a number from 1 to 12 on a tag board square. Place the numbers 1-12 in a large circle to form a clock face. Have the class stand or sit around the clock. Give 12 children each a time card to keep face down. Select two volunteers, one taller than the other, to stand in the center of the clock. Ask: "Who should be the minute hand? Why?" (The taller child should be the minute hand because the minute hand is the longer hand.) Ask: "Where should the taller child point to show 1 o'clock?" (To 12) Ask: "Where should the shorter child point?" (to 1) Students should take turns holding up their index cards.

Students should tell the children representing the hands where to point to show the time displayed. Repeat the activity until all children have a turn to show the time.

6. Have each student make a paper plate clock face. Using a brad fastener, attach tag board hands to the center of the plate. These clocks can be used in various reinforcement activities. For example, as teacher calls out a time, the students show the correct time on their clocks.

Part II: To the half-hour
1. Show 3 o'clock on a demonstration clock. Move the minute hand half-way around the clock to six while the class counts by fives. Ask: "How many minutes have passed? Where does the minute hand point? Where does the hour hand point? What time is it?" Write three-thirty, 3:30 and half past 3 on the overhead or chalkboard. Continue to move the minute hand around the clock to 12 while the class counts by fives. Ask: "How much time has passed? What time is it now?" Discuss the two ways to read time at the half hour. (3:30 and half past 3) Where is the minute hand at half past the hour?
2. The human clock in Part I may be used with time cards showing times to the half hour.
3. The paper plate clock can be used as a quick assessment by having students show times that the teacher calls out.
4. Have the students play "Time Concentration." Prepare cards showing several times on the hour and half hour. Prepare matching cards with clock faces illustrating these times. Turn all cards face down individually. Students may play one-on-one or in teams of two. One student turns over two cards, trying to match a clock face to the corresponding time card. If the times match, the student removes the two cards and keeps them, If the cards do not match, the student replaces them face down and the next player takes a turn. The game continues until all the cards are matched. The player with the most matches wins.

Part III: To the nearest five-minutes or minute
Adjust the activities in Parts I and II to reflect five-minute intervals or one-minute intervals.

Sample assessment
• Observe as students display the time on their paper plate clock. Check to make sure they understand the difference between the minute and hour hand. Pay particular attention during the human clock activity for the correct explanation of hand placement and pointing.
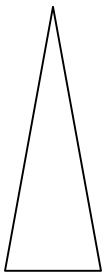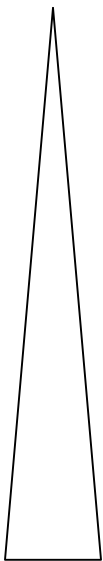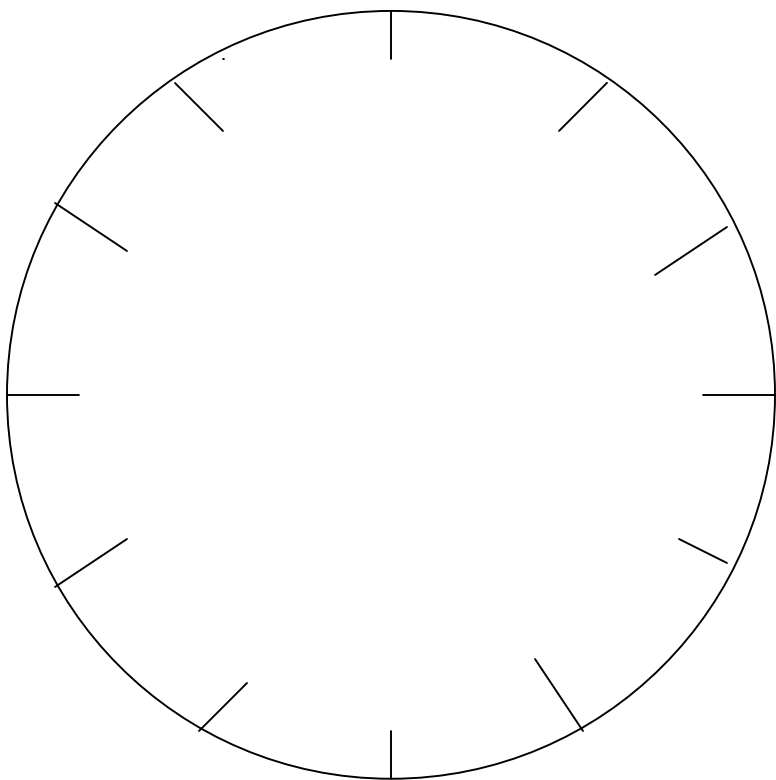
Was the Groundhog Correct?

Reporting category Measurement

Overview Students record the temperature for six weeks following Groundhog Day and determine if the Groundhog was correct in his prediction.

Related Standard of Learning 3.17

Objectives

- The student will read temperature to the nearest degree from real Celsius and Fahrenheit thermometers.
- The student will record the temperatures for a six-week period following Groundhog Day.
- The student will create a bar graph.

Materials

- Celsius thermometer
- Fahrenheit thermometer
- Internet site for average winter temperature and spring temperature

Instructional activity

1. This activity is appropriate as an application of reading thermometers. Using a physical model will provide practice reading Celsius and Fahrenheit thermometers prior to beginning this activity.

2. As Groundhog Day approaches, discuss the legend of the groundhog's shadow. Legend has it that if the groundhog sees his shadow, there will be six more weeks of winter. If he does not see his shadow, then there will be an early spring. Since Groundhog Day is February 2nd and the first day of spring is March 21st, about six weeks of time exists to verify whether the groundhog was correct in his prediction.

3. Students will have to determine first what qualifies as a winter temperature and what qualifies as a spring-like temperature.

4. The following information is for the teacher's use as students are not expected to learn these processes in third grade. For Richmond's climate, access the Web site http://www.erh.noaa.gov/er/akq/climate/RICnormal.txt and scroll down to the list of temperatures that are headed "average temperatures" (the third category). The daily temperatures for January, February, and March show that an estimate of an average winter temperature would be around 40 degrees F. Following the same process for April, May, and June, an average spring temperature would be around 60 degrees F. A ballpark estimate for the dividing line between winter temperatures and spring temperatures could be around 50 degrees F. To convert that temperature into Celsius, use http://www.usatoday.com/weather/resources/basics/temperature-conversions.htm. Using the conversion rule, the 50 degrees in Fahrenheit would be roughly equivalent to 10 degrees Celsius. The same process could be used for the Norfolk area by accessing the following Web site: http://www.erh.noaa.gov/er/akq/climate/ORFnormal.txt. While the preceding process is not as exact as a meteorologist would use, it will suffice for the purpose of the lesson.

5. Once students are familiar with reading the Celsius and Fahrenheit thermometers, assign children to take the readings around noon each day. Record the temperatures on sticky notes and assist the students in determining whether the temperature is a winter temperature or spring temperature. Construct two bar graphs with the sticky notes on two separate sheets of poster board. Label one sheet of poster board *Celsius* and the other *Fahrenheit* (two different colors of poster board would also help to keep the two measurement systems separate). Each bar graph will have two bars, one for the winter temperatures and one for the spring temperatures. As the decision is made each day, the sticky notes are placed in the proper location on the bar graph. Be sure that the bar graph is labeled appropriately with a title, and that the horizontal and vertical axes are also labeled. Ask questions that relate to the graph each day as the data accumulates. Students can also make their own predictions as to whether they agree with the groundhog's prediction.

6. At the end of the six weeks, verify with the data collected on the bar graphs whether the groundhog was correct or not.

Sample assessment

*   Thirty days of recording temperatures shown on real thermometers will allow each student in the class to perform the measurement. Provide additional assistance as needed.

Follow-up/extension

*   The following Web sites have additional activities and information related to Groundhog Day:
    http://www.groundhog.org/activities/
    http://www.education-world.com/a_lesson/lesson048.shtml

Sample resources

Curriculum and Evaluation Standards for School Mathematics, NCTM publication, 1989

Principles and Standards for School Mathematics, NCTM publication, 2000

Learning and Teaching Measurement: 2003 Yearbook with Classroom Activities Companion Booklet, NCTM, 2003 Information related to measurement and activities that go beyond the content.

http://standards.nctm.org/document/chapter5/meas.htm – Information on measurement from Principles and Standards for School Mathematics.

http://mathforum.org/paths/measurement/inchbyinch.html – A lesson from the Math Forum that uses literature to explore the concept of length.

http://mathforum.org/paths/measurement/e.measlessons.html – Ideas and resources for teaching measurement that includes lesson plans, materials, common questions, and software.

http://www.aimsedu.org/Activities/minimetrics/mini-metrics.pdf – A Mini-Metric Olympics activity from the AIMS organization.

www.mathcats.com – metric and US conversions, weather from around the world in Celsius and Fahrenheit.

http://www.time-for-time.com/swf/myclox.swf – excellent interactive clock site with analog and digital faces.

Released SOL test items

25 Use your centimeter ruler to help you answer this question.

Which is CLOSEST to the height of the birdbath in the picture below?
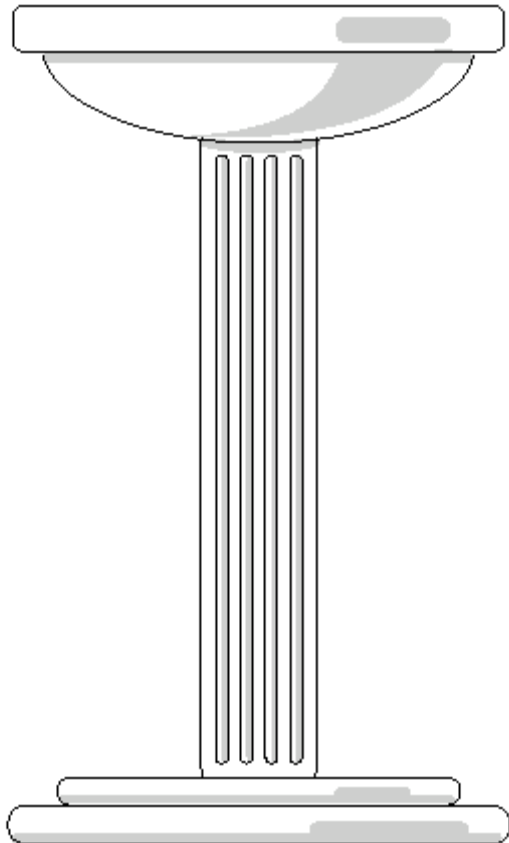
A 13 centimeters
B 12 centimeters
C 11 centimeters
D 10 centimeters

26 Each small square on the grid is 1 square unit.
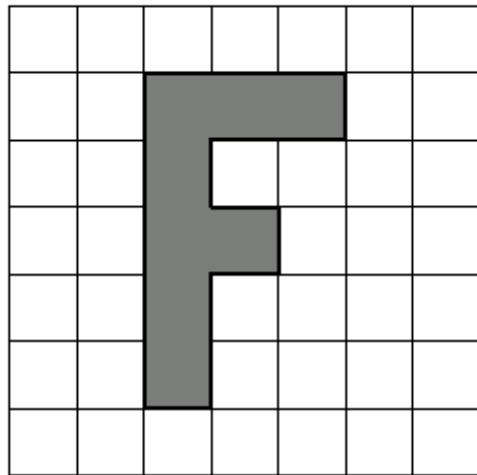
How many square units are needed to make the shaded figure shown on the grid?

F 7
G 8
H 15
J 18

28 Rob said that the time was 10:30.
    Which of the following clocks shows
    closest to 10:30?

F

G

H

J

29 Which of the following
    thermometers shows closest
    to 37 degrees Celsius?

A

B

C

D
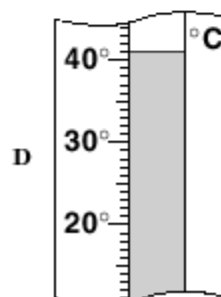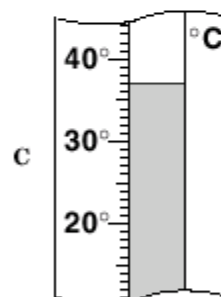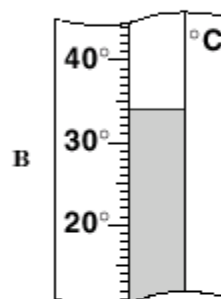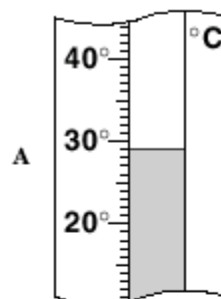
33 Which is CLOSEST to the amount of water Shelby's watering can will hold when full?

   A 1 gram

   B 1 pint

   C 1 cup

   D 1 gallon

34 On Saturday, Tad took exactly 60 minutes to finish his chores. How many hours did it take Tad to do his chores?

   F 1

   G 2

   H 3

   J 4

Organizing Topic   Geometry: Two-Dimensional (Plane), Three-Dimensional (Solid), Transformations

Standards of Learning

3.18   The student will analyze two-dimensional (plane) and three-dimensional (solid) geometric figures (circle, square, rectangle, triangle, cube, rectangular solid [prism], square pyramid, sphere, cone, and cylinder) and identify relevant properties, including the number of corners, square corners, edges, and the number and shape of faces, using concrete models.

3.19   The student will identify and draw representations of line segments and angles, using a ruler or straightedge.

3.20   The student, given appropriate drawings or models, will identify and describe congruent and symmetrical, two-dimensional (plane) figures, using tracing procedures.

Note: although perimeter and area are not included in the third-grade Standards of Learning, these concepts will need to be reviewed prior to the Standard of Learning Test. See Grade 2 Enhanced Scope and Sequence for lesson plans.

Essential understandings, knowledge, and skills	Correlation to textbooks and other instructional materials

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- Identify, by name, models and pictures of plane geometric figures (circle, square, rectangle, and triangle) and solid geometric figures (cube, rectangular solid, square pyramid, sphere, cone, and cylinder).

- Identify plane geometric figures by counting the number of sides, corners, and square corners.

- Identify geometric solids by counting the number of corners, square corners, and edges, and by the shapes of the faces.

- Classify, compare, and contrast plane and solid geometric figures (e.g., circle/sphere, square/cube, triangle/pyramid, and rectangle/rectangular solid), using corners, square corners, faces, and edges.

- Identify and locate examples of a point, line segment, and angle.

- Draw line segments and angles, using a ruler or straightedge.

- Locate examples of symmetrical figures, and verify their symmetry by using tracing procedures.

- Determine if given figures have a line or lines of symmetry (vertical, horizontal, diagonal), using tracing procedures.

- Locate examples of congruent figures and verify their congruency by laying one on top of the other.

- Determine if given figures are congruent, using tracing procedures.

All Cracked Up

Reporting category   Geometry
Related Standard of Learning 3.18

Objectives

- Students will follow oral instructions and create a set of tangrams.
- Students will identify geometric shapes and basic properties.

Materials needed

- 10 cm x 10 cm square of construction paper or a square piece of origami paper, one for each student
- 10 cm x 10 cm square of waxed paper for teacher demonstration
- Scissors

Instructional activity

Directions for folding and tearing tangrams:

1. Give each student a square piece of origami paper or a 10 cm-square piece of construction paper. At this point it is appropriate to talk about the attributes of a square and how to verify that it is actually a square.

2. Have students fold the square along a diagonal. It may be necessary to explain that a diagonal is the segment that joins two non-adjacent vertices. Have the students crease the diagonal and cut along the diagonal. Model this with a square of your own. See Figure 1.

3. Discuss briefly with students what two geometric figures they now have and what they know about them. They should have two congruent isosceles right triangles. Third graders will identify the figures as *triangles,* which is sufficient at this point. Demonstrate the concept of *congruence* (having exactly the same size and shape) by placing one triangle on top of the other so that it looks like only one triangle.

4. Have the students place one triangle to the side and place the other in front of them with the long side (hypotenuse) toward their "belly button" or parallel to the edge of their desk. Fold this triangle along the altitude from the vertex angle. It will be necessary to explain that the altitude from the vertex angle is the segment from the vertex that forms a square corner with side opposite. Have them cut along the altitude. Model this with your own triangle. See Figure 2.

5. Discuss briefly with students what two geometric figures they now have and what they know about them. (They should have two congruent isosceles right triangles.) Again, demonstrate the concept of congruence by placing one triangle on top of the other so that it looks like only one triangle. Ask, "Are these right triangles congruent to the one you put aside?" Students should be able to tell you that they are the same shape, but not the same size, so they are not congruent. Have the students label these triangles *1* and *2*.

6. Have the student take the remaining large right triangle and place it in front of them with the long side (the hypotenuse) toward their "belly button" or parallel to the edge of the desk. Have them take the vertex of the right angle and fold it down to the midpoint of the opposite side. Model this with your own triangle. Show them what it should look like – a small triangle folded over a trapezoid. Cut along the fold line. Label the new triangle *3*. See Figure 3.

7. Discuss briefly the two geometric figures they now have – an isosceles right triangle and an isosceles trapezoid. Students may not know what a trapezoid is; now is a good time to introduce it to them — a four-sided figure with exactly one pair of parallel sides.

8. Have the students take the trapezoid and place it in front of them with the longer side toward their "belly button," or parallel to the edge of the desk. Have the students fold the trapezoid along the height of the trapezoid that connects the midpoints of the two bases. Model for them using your trapezoid. Cut along the fold. See Figure 4.

9. Discuss with the students the two geometric figures you now have – two congruent trapezoids. This is a good time to discuss the similarities and differences in the two trapezoids they have seen thus far.

10. To assist students in following the next steps, place the following diagram on the board or overhead.
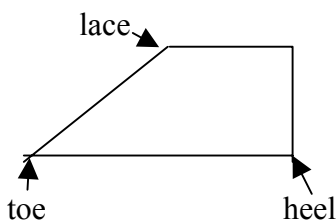
Say to students: "This is now what we are going to call a shoe. You have two of them - place one in front of you and put the other aside. Take the toe and fold it back to the heel." Model with your own shoe. (When the fold is complete, it should look like a triangle on top of a square.) Cut along the fold. Label the triangle *4* and the square *5*. Continue the discussion of geometric figures and what they now have. They should have an isosceles right triangle similar to the others and a square. Ask how they can verify that have a square. See Figure 5.

11. Have the students take the second shoe and place it in front of them, facing like the model on the board or overhead. Have student take the heel and fold it to the lace. Model with your second shoe. (It should look like a triangle folded over a parallelogram.) Cut along the fold. Label the small triangle *6* and the parallelogram *7*. See Figure 6.

12. Finish the discussion of geometric figures. They should now have a small isosceles right triangle and a parallelogram. Is the triangle congruent to the others? Talk about the properties of a parallelogram.

13. Have the students make sure that they each have seven labeled pieces. Now have them put the seven pieces back together into a square like the one they had at the beginning of the lesson.

14. At the end of this activity, give each student an envelope with holes punched for a three-ring binder and have them store the pieces for future work.

Figure 1.

crease and cut

Figure 2.

crease and cut

Figure 3.

crease and cut

Figure 4.

crease and cut

Figure 5.

crease and cut

crease and cut
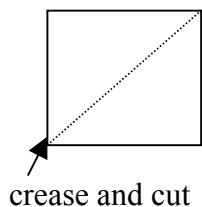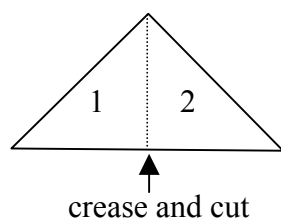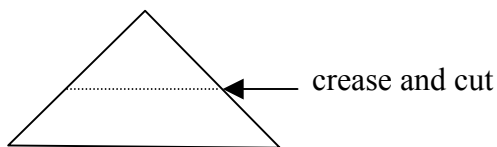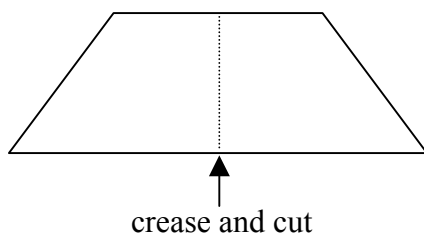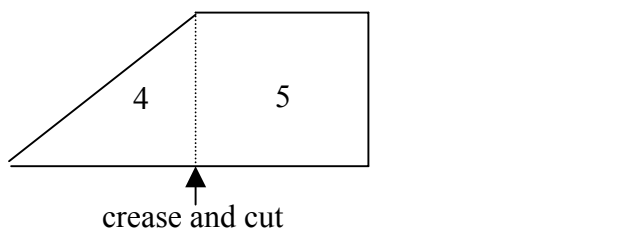
Figure 6.
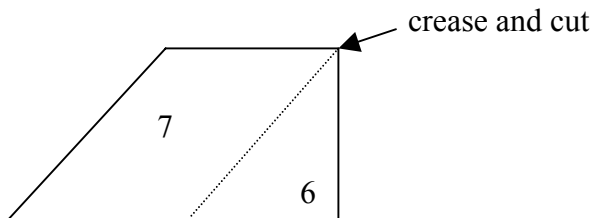
Sample assessment

- Watch carefully as students follow your instructions. Answer all questions that may be asked. Circulate to be sure that all students are with you and folding correctly. As students try to reassemble the square, circulate and talk with them about the strategies they are using.

Follow-up/extension

- Talk about what fractional part one piece is of another and of the whole. Have students use each other's pieces to fit pieces together to determine the fractions. Students can also complete the "All Cracked Up" sheet in which they describe each of the seven shapes by its name, number of sides, number of corners, and number of square corners.

All Cracked Up

Steps

- Identify each tangram piece by the name of its shape.
- Which pieces are the same size? How do you know?
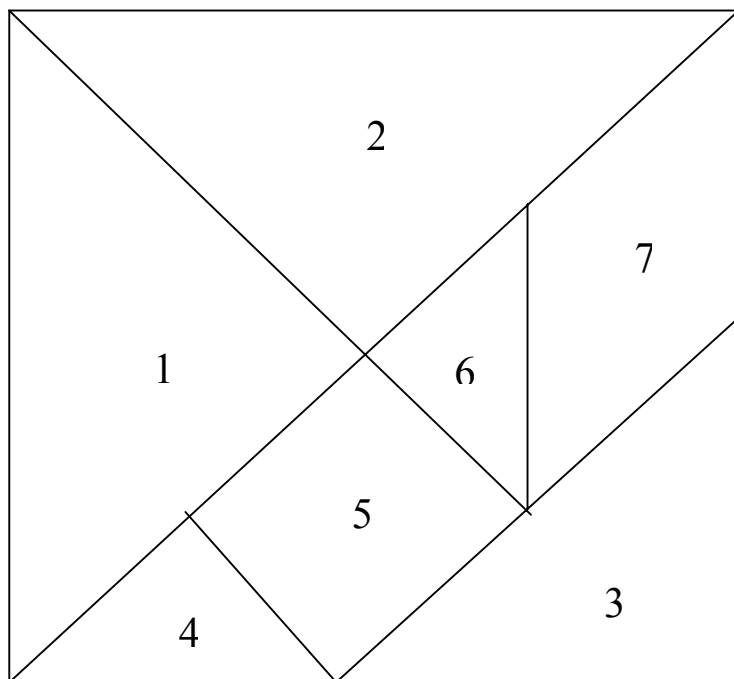
Piece #	Name	No. of Sides	No. of Corners	No. of Square Corners
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____

Building Polyhedra

Reporting category   Geometry

Related Standard of Learning   3.18

Objective

- Students will determine the figures that form various polyhedra and analyze how the figures fit together to form polyhedra.

Materials needed

- Scissors
- Tape or glue
- Geometric solids
- Nets for geometric solids, one set for each small group
- "Building Polyhedra" recording sheet, one copy for each student

Instructional activity

1. *Initiating Activity:* Discuss the term *net* with the class. Be sure students understand that a net is a two-dimensional pattern that can be folded into a solid. A net shows all the faces of a solid and the relative positions of the faces. On the overhead, model making a net by tracing each of the faces of a solid to form its net. Discuss with them the number and shape of each of the faces, the number of edges, the number of corners, and the number of square corners.

2. Distribute scissors, tape or glue, and several nets to small groups of students. (Be sure to indicate to the class that these nets have extra pieces — the flaps to make it easier to fold and tape together.)

3. Small groups should predict which solid the net will make and record it on the recording sheets. The teacher may show several solids, one of which will be formed when the net is folded.

4. After the predictions are made, the students should cut out the net, fold, and tape it together. The students should compare their solids to their predictions and to the original solids. The students should then complete the information requested on the recording sheet.

Sample assessment

- Circulate around the room and listen as the groups discuss their predictions. Make sure that everyone is involved and contributing to the group. Have each group discuss their solid and be prepared to "introduce' their solid to the class.

Follow-up/extension

- Have the students identify the solid by the shape and number of faces, number of edges, and number of corners and square corners that make up a particular solid.
  - ° Example: Which solid has no edges, no faces, and no corners?
  - ° Example: Which solid has a rectangular face, five corners, and four triangular faces?

Recording Sheet: Building Polyhedra

Net (Make a copy of the net here)	Prediction	Name of Solid	Number of Faces	Shape of Faces	Number of Edges	Number of Corners	Number of Square Corners

Net for Rectangular Prism
--Cut on solid line; fold on dashed line
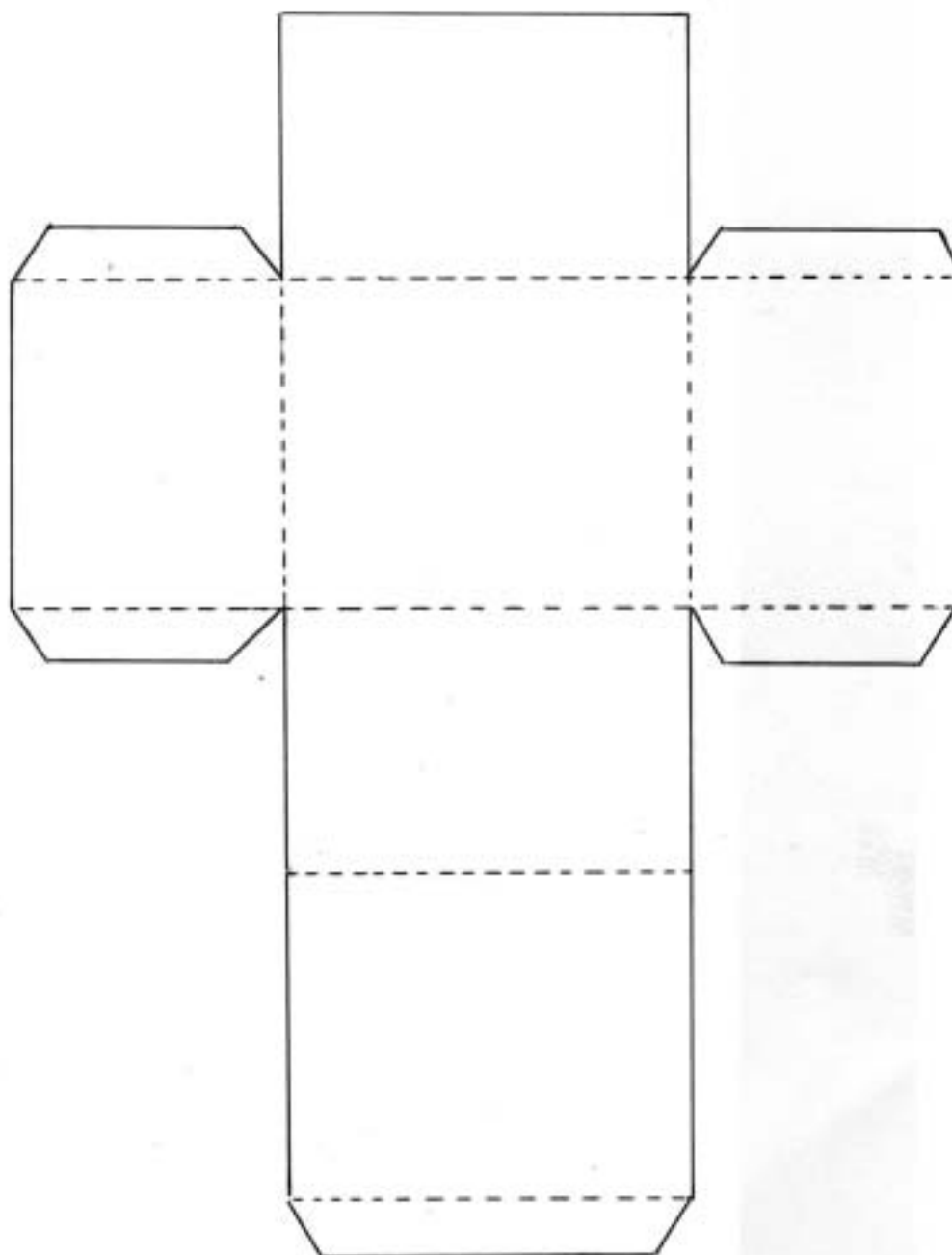
Net for Cylinder
--Cut on solid line; fold on dashed line
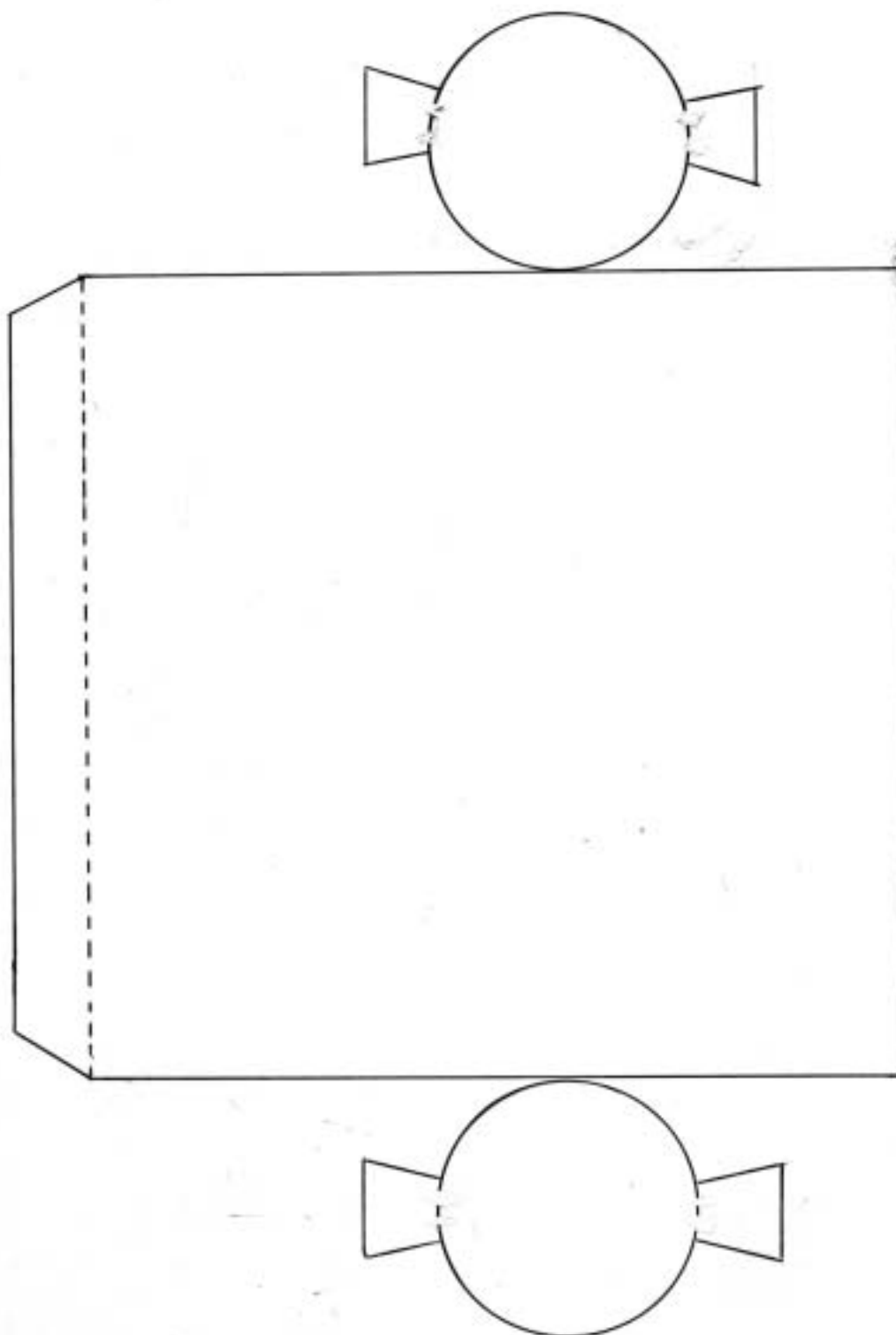
Net for Cube
--Cut on solid line; fold on dashed line
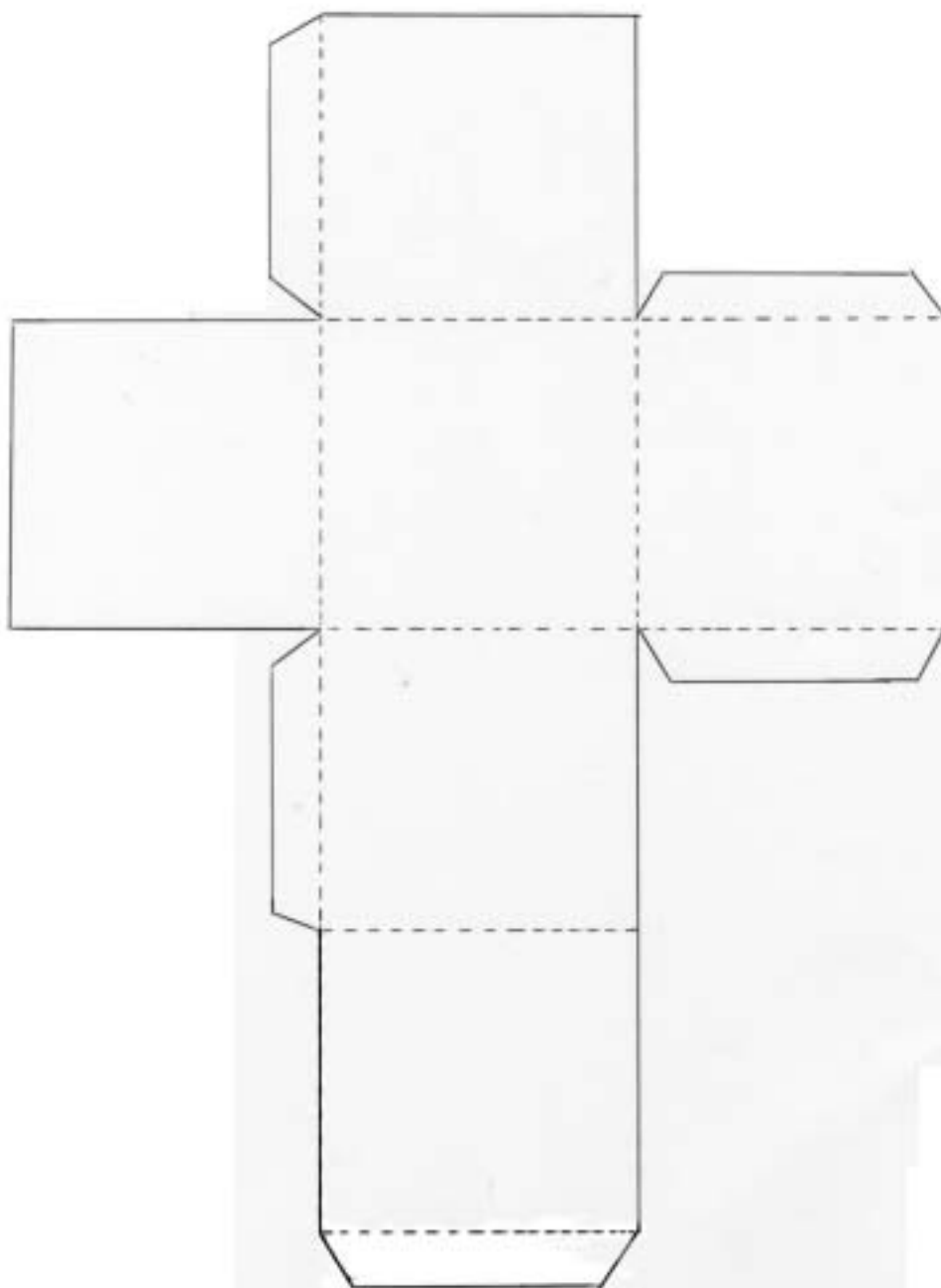
Net for Cone
--Cut on solid line; fold on dashed line
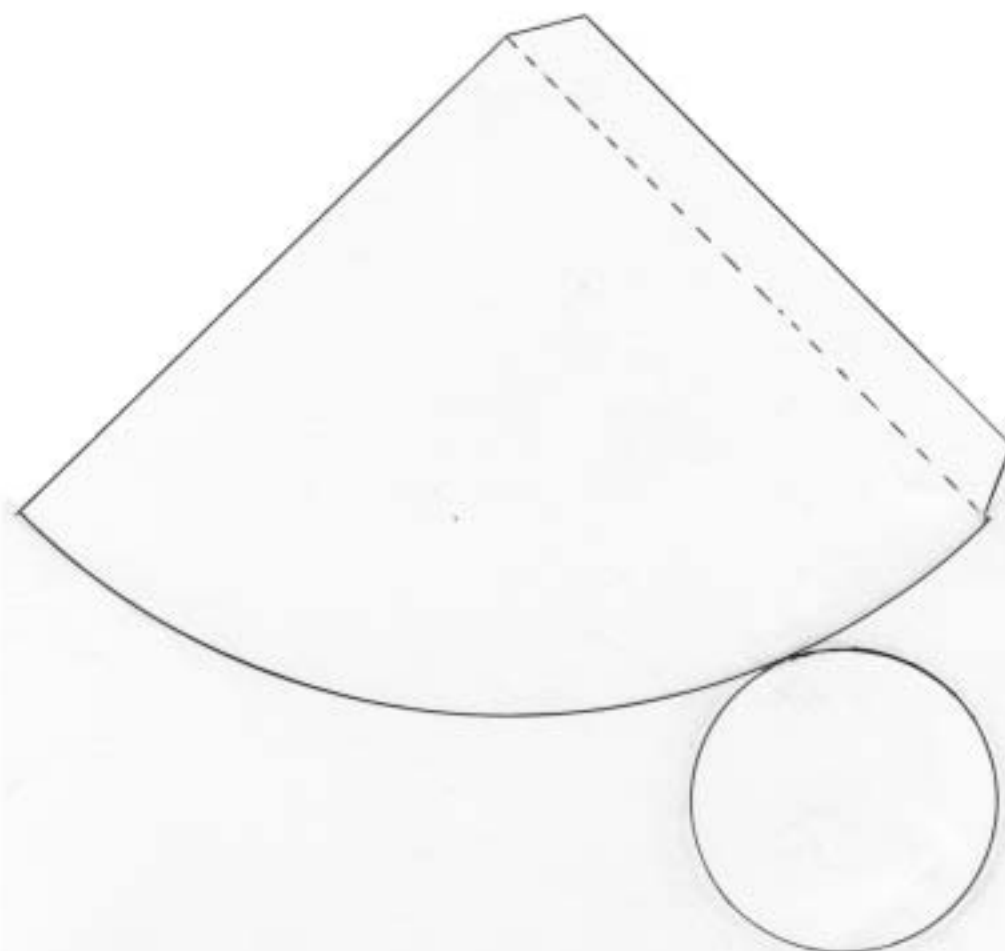
Net for Square Pyramid
--Cut on solid line; fold on dashed line
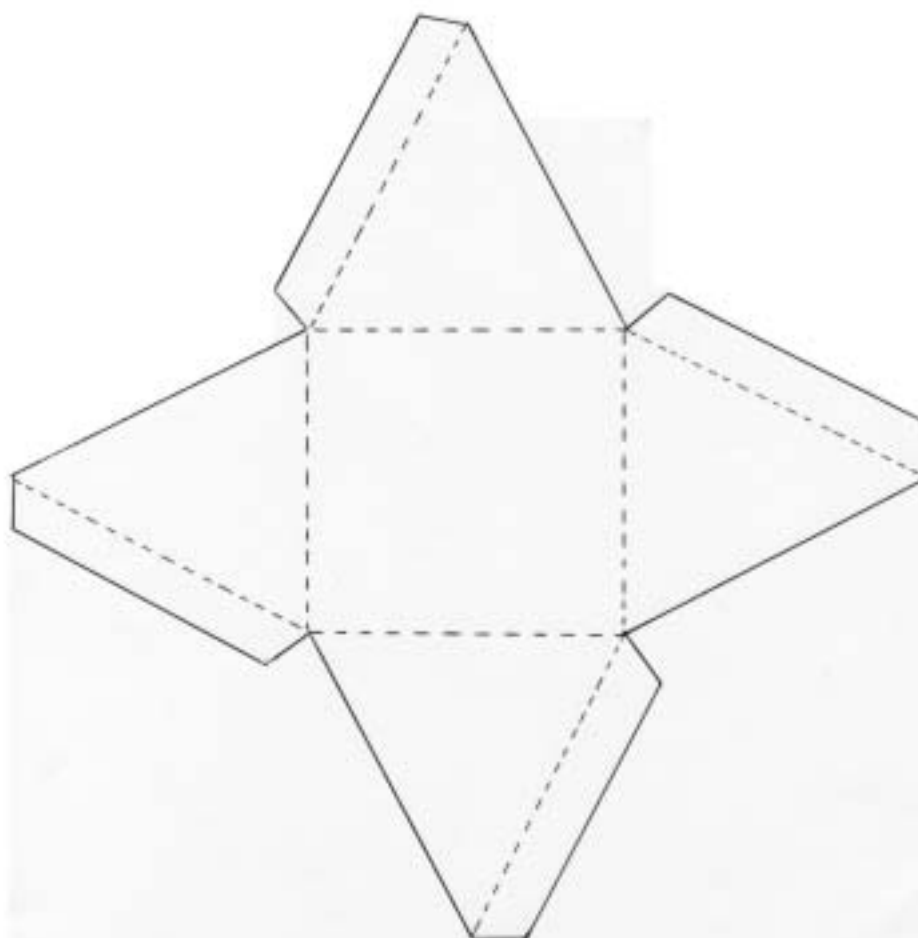
What's My Shape? Touch Me

Reporting category   Geometry

Related Standard of Learning   3.18

Objective

- Students will determine the polyhedron in the bag by touch alone.

Materials needed

- One set of geometric solids
- A paper bag

Instructional activity

1. *Initiating Activity:* Using the set of geometric solids, review with the class the names of the solids (cube, cone, cylinder, square pyramid, rectangular prism, and sphere), and the important features of each — number and shape of faces, number of edges, numbers of corners, and numbers of square corners.

2. Out of sight of the students, place a polyhedron in the bag. Say to the students, "This bag contains a polyhedron. Your job is to figure out which polyhedron is in the bag." Shake the bag so that students can hear. "One of you at a time may put your hand into the bag and touch the solid. You may not look into the bag. Just by touching, you are to try to figure out what is in the bag."

3. The students take turns touching the solid in the bag without looking and try to figure out what the solid is. Allow them to discuss what they felt as they attempt to identify the solid. Each student should record his/her prediction.

Sample assessment

- Listen to the discussions that take place. You are listening for features that you discussed earlier – number of faces, corners, edges or no edges. After each student has touched, discussed, and recorded his or her prediction – reveal the solid and check to see how many were correct in their prediction. Do this activity in small groups and have a student give clues based on the feel of the shape. Have another student record the clues and the group's selection. Then have them check to see if they were correct. Share the results with the whole class and discuss strategies.

What's My Shape? Ask Me About It

Reporting category   Geometry
Related Standard of Learning   3.18

Objective

- Students will use logical reasoning to determine the polyhedron in the box after asking questions and receiving information about it.

Materials needed

- One set of geometric solids
- Box or bag

Instructional activity

1. *Initiating Activity:* Using the set of geometric solids, review with the class the names of the solids (cube, cone, cylinder, square pyramid, rectangular prism, and sphere), and the important features of each — number and shape of faces, number of edges, number of corners, and number of square corners.
2. Out of sight of the students, place a polyhedron in the bag or box. Say to the students, "This box (or bag) contains a polyhedron." Shake it so the students can hear. "I'd like you to ask me some questions that have 'yes' or 'no' answers to figure out what is in the box."
3. Questions and answers continue until the class can identify what shape is in the box.
4. Continue the process with a different polyhedron. Encourage the students to refine their questioning so that fewer questions are needed for identification.

Sample assessment

- Listen carefully to the questions that are asked – are they just random questions or are the students refining their questioning techniques so that certain solids can be readily eliminated? After several shapes, discuss what questions seem to be most helpful and try some more. Do students recognize the importance of particular types of questions?

Sample resources

http://standards.nctm.org/document/chapter5/geom.htm – - NCTM Principles and Standards information related to geometry in Grades 3-5.

http://illuminations.nctm.org/imath/3-5/GeometricSolids/index.html – an I-math investigation of geometric solids.

http://www.learnnc.org/LearnNC/lessonp.nsf/docunid/E59C22A90A8A43F485256831007443D4?opendocument – a lesson plan on congruent figures.

http://www.learnnc.org/LearnNC/lessonp.nsf/docunid/272DFA – a lesson plan on constructing three-dimensional figures.

http://www.learner.org/teacherslab/math/geometry/space/ – lessons plans that focus on visualization of three-dimensional objects.

VDOE Geometry Instructional Module – professional development training module that contains activities that can be adapted for student use.

Navigating through Geometry in Grade 3 through Grade 5 - available from NCTM. Contains additional lessons for geometric activities.

Van Hiele Levels of Geometric Thought CD – available through the Virginia Department of Education – contains assessments to determine children's level of geometric thinking

Released SOL test items

27 Which is a model of a rectangular solid?

A

B

C

D

30 How many lines of symmetry does the figure below have?

F 1
G 2
H 4
J 6

31 Each of the street signs below shows a different kind of road. Which sign shows a road that is the BEST model of a line segment?

A

B

C

D
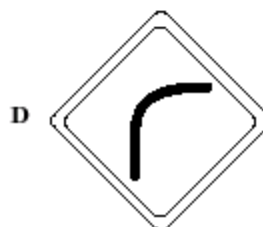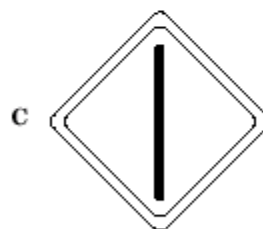
35 Which of the following is shaped most like a cylinder?

A

B

C

D ORANGE JUICE
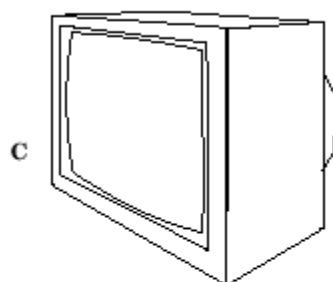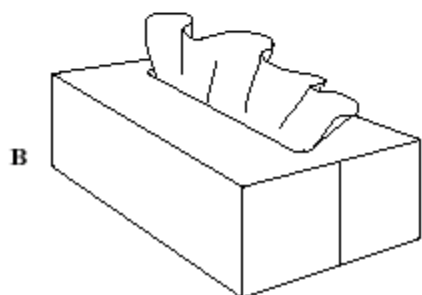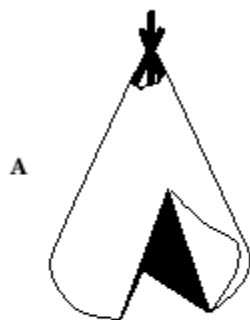
36 Wayne cut this shape out of a piece of paper.
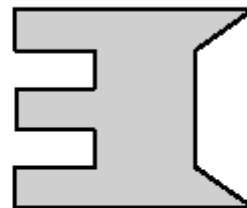
Which of the following is missing a piece exactly the same size and shape as the piece shown above?

F

G

H

J
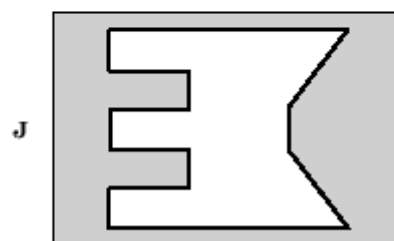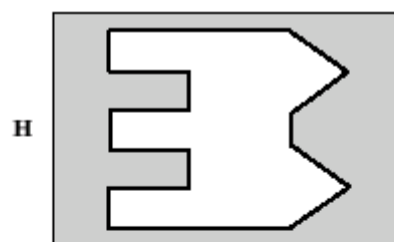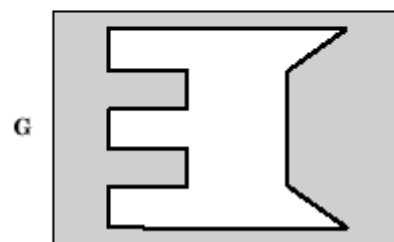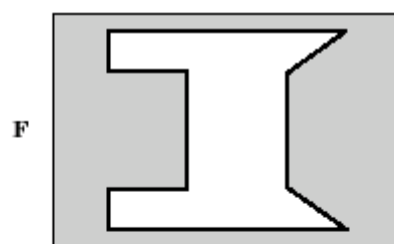
Organizing Topic   Statistics

Standard of Learning

3.21   The student, given grid paper, will
      a) collect and organize data on a given topic of his/her choice, using observations, measurements, surveys, or experiments; and
      b) construct a line plot, a picture graph, or a bar graph to represent the results. Each graph will include an appropriate title and key.

3.22   The student will read and interpret data represented in line plots, bar graphs, and picture graphs and write a sentence analyzing the data.

Essential understandings, knowledge, and skills	**Correlation to textbooks and other instructional materials**

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- Formulate questions to investigate.

- Design data investigations to answer formulated questions, limiting the number of categories for data collection to four.

- Collect data, using surveys, polls, questionnaires, scientific experiments, and observations.

- Organize data and construct a bar graph on grid paper representing 16 or fewer data points for no more than four categories.

- Label bar graphs with a title, a description of each axis, and a key where appropriate. Limit increments on the numerical axis to whole numbers representing multiples of 1, 2, 5, or 10.

- Read the information presented on a simple bar or picture graph (e.g., the title, the categories, the description of the two axes, the key).

- Read information presented in line plots.

- Analyze and interpret information from simple picture and bar graphs, with data points limited to 16 and categories to 4, by writing at least one statement.

- Analyze and interpret information from line plots, with data points limited to 16, by writing at least one statement.

- Describe the categories of data and the data as a whole (e.g., data were collected on four types of eggs — scrambled, fried, hard boiled, and egg salad — eaten by students).

- Identify parts of the data that have special characteristics, including categories with the greatest, the least, or the same (e.g., most students prefer scrambled eggs).

- Select a correct interpretation of a graph from a set of interpretations of the graph, where one is correct and the remaining three are incorrect. For example, a bar graph containing data on four types of eggs — scrambled, fried, hard boiled, and egg salad — eaten by students shows that more students prefer scrambled eggs. A correct answer response, if given, would be that more students prefer scrambled eggs than any other type of eggs.

Statistics through the Year

Reporting category   Probability and Statistics

Overview   Opportunities for data collection and interpretation are available throughout the school year and in all subject areas. This activity addresses various ideas for data collection and interpretation.

Related Standards of Learning 3.21, 3.22

Objectives

- The student will formulate questions to investigate.
- The student will collect data.
- The student will organize data and construct a bar graph or picture graph.
- The student will analyze and interpret information from graphs.
- The student will identify parts of the data that have special characteristics.

Materials needed

- Chart paper
- Digital pictures of students to use for symbols on a bar graph

Instructional activity

1. Students need to be engaged in a variety of data collection activities that are based on real-life situations. The beginning of the school year presents opportunities to collect data about students as they get to know each other. Have students suggest questions that they would like to ask to find out information about their classmates. Typical information that could be collected through a survey includes: favorite TV shows, favorite vacation spot, types of pets, favorite number, bus number, number of pets, hours of sleep, time to go to bed, number of teeth lost, lunch counts, attendance, measures of height, long jump distance, number of letters in their first name.

2. Each day post one of the questions in a prominent place. As students enter the classroom they can answer the question by placing a marker in the appropriate place. Ideas for graphing include:
   - Chart paper that has grids for bar graphs and using student photos in the bars to record the data
   - Egg cartons stacked and labeled and pom-poms used to record the data
   - Plastic cups labeled and popsicle sticks labeled with student names inserted in cups to record data
   - Unifix cubes placed on the bars of a graph to record individual counts of data
   - Weather graph created on poster board and mounted on bulletin board. Six columns labeled at the bottom of the graph with types of weather (sunny, foggy, windy, snowy, cloudy, rainy). Unifix cubes are placed on permanently mounted pushpins to record the weather for the day.

3. After all data has been collected for the survey question of the day, have students make observations and brainstorm types of questions that could be asked about the data. Questions could include:
   - Which category has the greatest amount, least amount?
   - Are there more students with _____ or with _____?

- Are there fewer students with ____ or with ____?
- Are there any categories that have the same amount?
- How many _____ and ____ are there together?
- How many more (or fewer) ____ are there than ____?

4. The graphing process can be applied in all subject areas, but especially in science and social studies. Use these opportunities to reinforce the process.

Sample assessment

- Students need to have individual copies of the graphs that are done as a whole class so that they can begin to construct graphs. Provide students with recording sheets similar to the graphs used in class and allow the students to fill in the data, the title, labels on the axes, increments indicated on the graph, spaces between the bars, and a key if appropriate.
- Students can write in their mathematics journals about the process of constructing a graph and for particular graphs, the type of information they could determine from the graph.

Data Mania

Reporting category   Statistics

Overview   Students collect data on the color of their clothing and create an object graph. From the object graph, students represent the data in a bar graph. Then students construct a line plot.

Related Standard of Learning   3.21

Objectives

- Students will collect data.
- Students will construct a line plot, a picture graph, and a bar graph.

Materials needed

- Multilink or unifix cubes of various colors
- Construction paper squares to match the colors of the cubes
- "T-Shirt Pattern," one copy for each student
- Scissors
- Crayons or markers
- Grid paper

Instructional activity

Part I: T-shirt colors

1. Ask each student to select a cube that most closely matches the color of their clothing.
2. Collect the data by having the students place their cubes on the matching colored-paper square that have been placed around the room.
3. Collect all of the cubes on the colored squares and make an object graph with the cubes (place the cubes on the floor or tape them to the wall).
4. Add a title, label the axes and create a key.
5. Next, have the students color in the T-shirt pattern to match their cube and cut it out.
6. Ask for suggestions on how to organize the data (sort by colors).
7. Tape each T-shirt up on the wall to construct a picture graph with appropriate labels and key.
8. Discuss with the students the similarities and differences between the two graphs constructed so far.
9. Give each student a piece of grid paper.
10. Have them construct a bar graph from the T-shirt color data.
11. Be sure that each bar graph has
    a. Title (must describe the data)
    b. Axes (both axes must be drawn)
    c. Increments (axis showing numerical data marked off into appropriate equal increments)
    d. Labels (both axes labeled)
    e. Spaces (equal spaces between the bars)

12. Discuss the similarities and differences between the three graphs constructed. Record these on chart paper. Have students share their thoughts about which graph was easiest to construct and which one is easiest to read, and why they feel this way.

13. Have the class draw at least one conclusion from the graphs.

Part II: Sticky note line plots

1. Decide on a question to be investigated (e.g., How many people live in your house?).

2. Gather the data by having each student write his/her name and the number of people living in their house on a sticky note.

3. Draw a number line on the chalkboard that includes the least and greatest pieces of data. Have students place their sticky note above the corresponding data point on the number line.

4. Students can then use grid paper to create a line plot that matches the sticky line plot. Each sticky note will be recorded as one x on the line plot.

5. Discuss the range and shape of the data using the line plot. Look for places the data is clustered.

6. Be sure to have students title the line plots.

7. Have the students use the line plot to construct a bar graph of the data.

8. Discuss the similarities and differences of the two graphs.

9. Have the students draw at least one conclusion from the graphs.

Part III: Heights

Below is an example of a line plot follows with sample questions that students could formulate about the data. Each X represents one student.

Heights of Kindergartners

```
                                        X
                      X      X      X
              X       X      X      X                    X
      X       X       X      X      X      X             X
      |-------|-------|------|------|------|------|------|
     35      36      37     38     39     40     41     42
```
Height in Inches
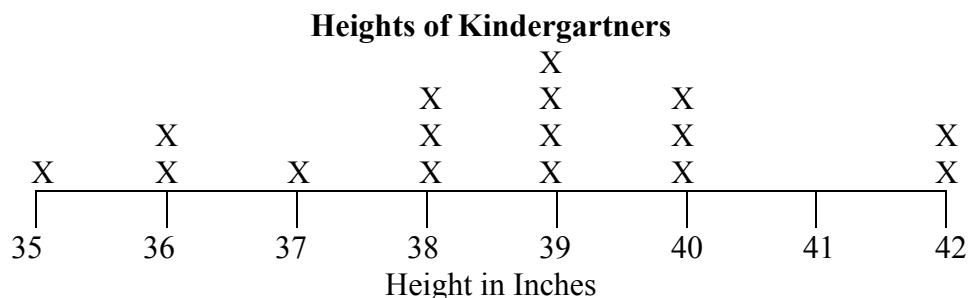
1. How many students are taller than a yardstick? (13)
2. How many students are 39 inches tall? (4)
3. How much taller is the tallest child than the shortest child? (7 inches)
4. Which height is shared by the most students? (39 inches)
5. Susie is the shortest student in the class. How tall is Susie? (35 inches)

Sample resources

http://illuminations.nctm.org/swr/list.asp?Ref=1&Std=4&Grd=-1 – lessons that focus on data collection and representation with manipulatives such as shoes, M & Ms and personal characteristics.

Curriculum and Evaluation Standards for School Mathematics, NCTM publication, pp.54-57

Principles and Standards for School Mathematics, NCTM publication, 2000

NCTM Addenda Series, Grade 4

www.nces.ed.gov/nceskids/Graphing/ –– An interactive Web site for students that allows them to create several types of graphs

http://illuminations.nctm.org/swr/list.asp?Ref=1&Std=4&Grd=3 – list of web resources reviewed by NCTM containing activities for data and probability.

http://standards.nctm.org/document/chapter5/data.htm – information from NCTM Principles and Standards in relation to data analysis for Grade 3 through Grade 5.

Probability and Statistics Professional Development Module available from VDOE Web site – contains activities related to this strand that can be modified for student use.

Navigating through Data Analysis and Probability in Grade 3 through Grade 5 - available from NCTM. Contains additional lessons for data analysis activities.

T-Shirt Pattern
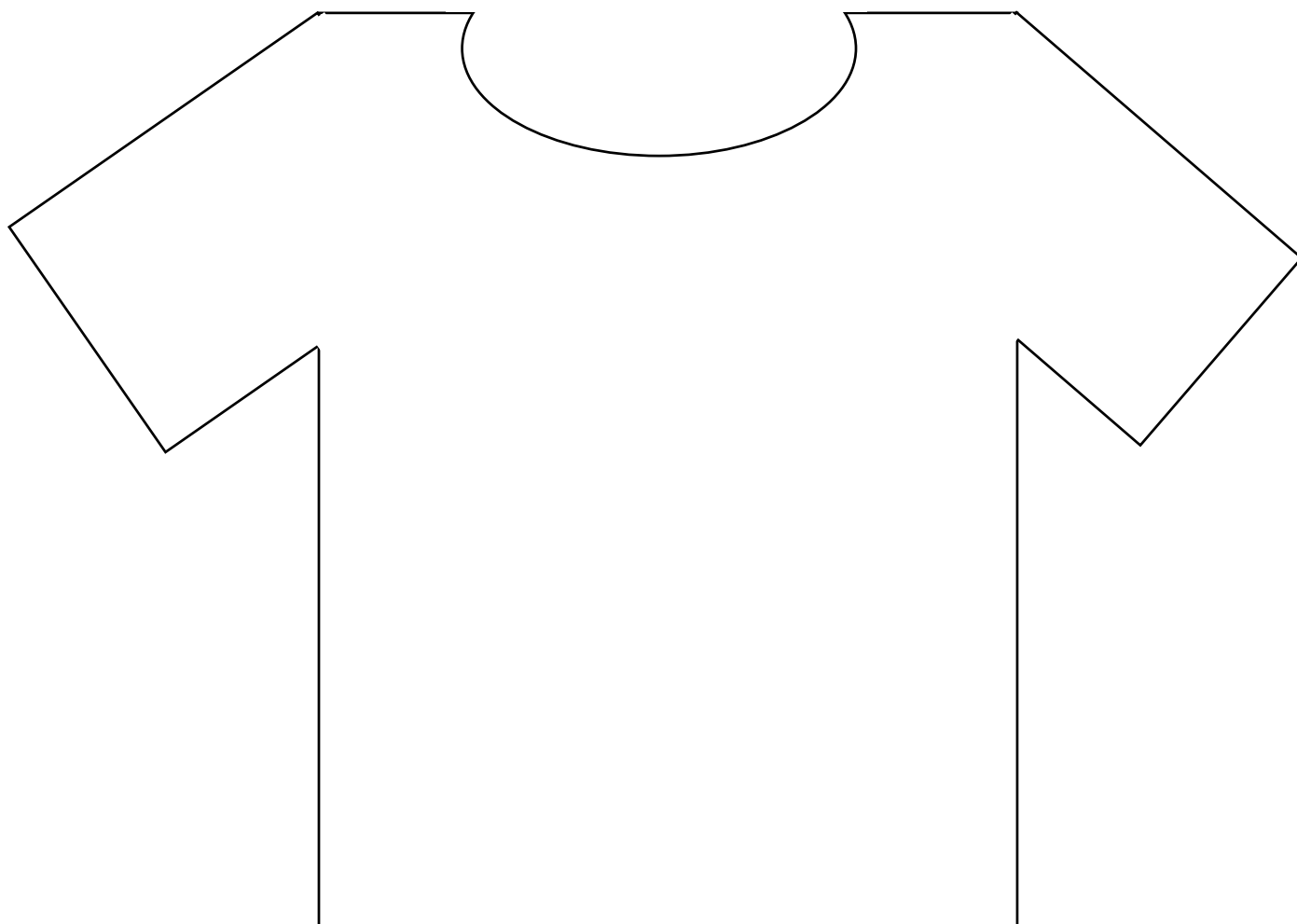
Sample SOL Released Test Items

38 The bar graph shows the number of different kinds of birds that Karen saw at her bird feeder last week.

Birds Seen

Kind of Bird — Robin, Cardinal, Woodpecker, Hummingbird

Number of Birds Seen: 0 1 2 3 4 5 6 7 8 9 10 11 12
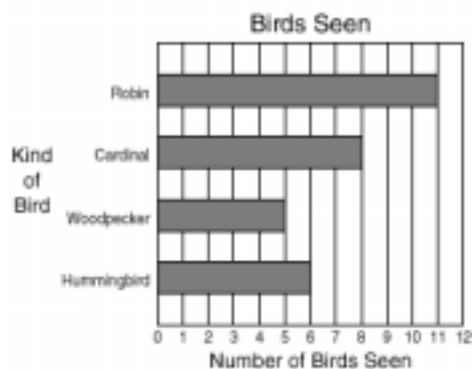
How many more robins than woodpeckers did she see?

F 11
G 6
H 5
J 3

39 The picture graph shows the numbers of 4 different kinds of plants Mr. Swan bought Saturday.

Plants Bought

Kind of Plant	Number Bought
Peppers	🌿 🌿 🌿
Tomatoes	🌿 🌿 🌿 🌿 🌿
Beans	🌿 🌿 🌿 🌿 🌿 🌿
Carrots	🌿 🌿

Key 🌿 = 5 plants.

How many pepper plants did Mr. Swan buy?

A 15
B 10
C 8
D 3

40 The bar graph below shows the number of each kind of bill that Kim counted.

Cash Box Money

Number Counted: 0 2 4 6 8 10 12 14 16

Kind of Bill: $1, $5, $10, $20
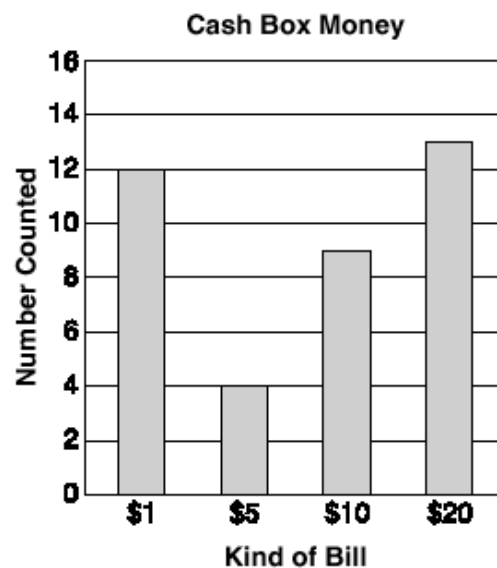
How many $10 bills did Kim count?

F 4
G 5
H 9
J 11

41 The picture graph shows the number of children who came to story hour each week.

Story Hour Attendance

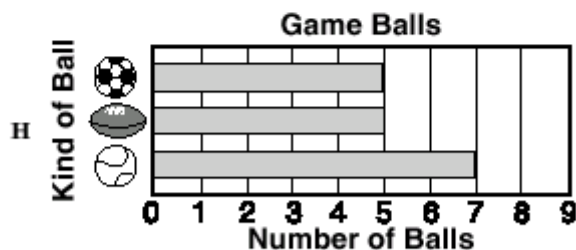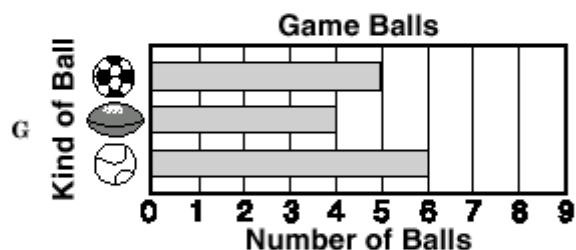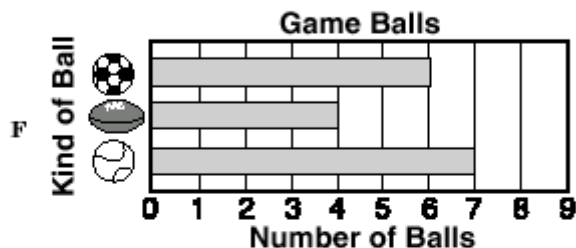| Week	Number of Children
1	😊 😊 😊 😊
2	😊 😊
3	😊 😊 😊 😊 😊 😊
4	😊 😊 😊 😊 😊
5	😊 😊 😊
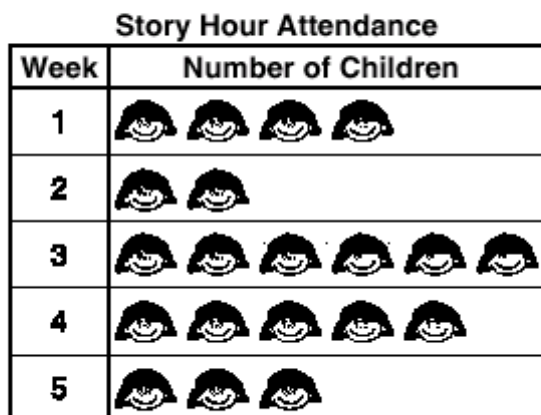
KEY: 😊 = 3 children.

How many children came to story hour in week 4?

A 5
B 8
C 12
D 15

42 These are the game balls Coach Warner used for P.E. class.

Which graph shows the correct number of each kind of game ball?

Game Balls

F

Game Balls

G

Game Balls

H

Game Balls

J
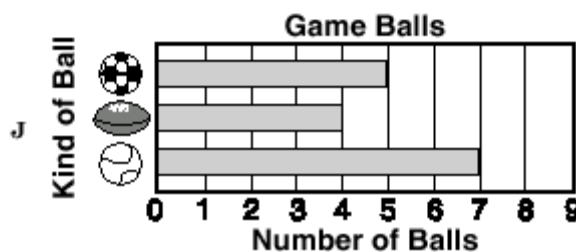
Organizing Topic Probability

Standard of Learning

3.23   The student will investigate and describe the concept of probability as chance and list possible results of a given situation.

Essential understandings, knowledge, and skills	**Correlation to textbooks and other instructional materials**

The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to

- Define probability as the chance that an event will happen.

- List all possible outcomes for a given situation (e.g., heads and tails are the two possible outcomes of flipping a coin).

- Identify the possible outcomes for a common event, using terms such as *impossible*, *unlikely*, *equally likely*, *likely*, and *certain*.

Two-Color Counter Toss

Reporting category   Probability

Related Standard of Learning   3.23

Objective

- Students will determine the possible outcomes of a simple experiment.

Materials needed

- Two-color counters or two-color beans or coins, three for each student
- Blank paper for recording and tallying
- Pencils or markers

Instructional activity

1. *Initiating Activity:* Discuss with the class what they think *should* happen if they tossed the counter. When it lands, will it always be red? When it lands, will it always be yellow? Help them see that are two possibilities – it could be red, or it could be yellow. (The probability is equally likely – it could land on red or yellow.) Ask, "What do you think would happen if you tossed the counter ten times? Will there be more red, more yellow, or the same amount of each?" Have each student predict and record his or her prediction. Group the students in pairs and have each pair discuss their predictions before actually conducting the experiment. Have each pair toss the counter ten times, keeping track of which color lands face up. Let each pair decide how they will record their results. When they have finished tossing, they should discuss the following questions with their partner:

   - Did your prediction match your results? Are you surprised? Why?
   - If we added your results to the results of another pair, what do you think the results would be? Why?
   - Do you think your results would be different if you tossed the counter more times? How would it be different? Why?
   - What do you think would happen if we combined all the results on a class chart?

   Have the students record their results on a class chart.

									TOTAL
Red									
Yellow									

   Ask students to total the reds and the yellows. Ask, "Are the class totals closer to your prediction? Why?"

2. Ask, "If you toss two two-color counters, what are the possible outcomes?" Students will most likely agree that there are three possible outcomes — two red, two yellow, or one red and one yellow. Before they begin the experiment, ask them to predict which outcome they believe will happen most often if they toss the counters 10 times and record the result of each toss. Again let each pair decide how they will record the results. Have the students toss two two-color counters ten times and record the result of each toss. Have the students discuss the results with their partner, and then change their prediction if they would like. When they have finished tossing, they should

discuss the following questions with their partner: "Do you think your results would be different if you tossed the counter more times?" "How would it be different?" "Why?"

3. Have the students toss the counters ten more times and record the result of each toss. When they have finished tossing, they should discuss the following questions with their partner: "Did you change your prediction?" "If so, why?" "What happened the more times the two counters were tossed?" "If the class combines their results, what do you think will happen?"

Have each pair record their results on a class chart.

									TOTAL
2 Red									
2 Yellow									
1 Red, **1 Yellow**									

4. Have students discuss the class chart, first with their partner and then with the whole class. Students may be surprised to discover the 1 red and 1 yellow occurred most often. (If this result did not happen, you may want each pair to toss ten more times so that a larger sample is obtained.) If students want to know why this outcome happened, explain that the three outcomes did not have an equal chance of occurring. To help students see what is happening; label both sides of one counter with a *1* and both sides of the second counter with a *2*. The possibilities can be recorded in a table, which may help students understand what is happening.

	Counter # 1	**Counter # 2**
2 Red	**Red**	**Red**
2 Yellow	**Yellow**	**Yellow**
1 Red,	**Red**	**Yellow**
1 Yellow	**Yellow**	**Red**

Note: Third-grade students may not be ready to fully appreciate the fact that red, yellow can happen in two ways while the other outcomes can occur in only one way. A full understanding of this information is not essential — an intuitive understanding is fine.

Sample assessment

- While students are carrying out each experiment, circulate around the room and listen to their discussions. Correct any misconceptions that are apparent and encourage them to do further experimentation.

Follow-up/extension

- Students need many opportunities to explore possible outcomes of an experiment. The same activity can be done with two pennies or a penny and a dime.

Sample resources

http://standards.nctm.org/document/chapter5/data.htm#bp4 – NCTM's Principles and Standards information about probability at the 3-5 grade levels.

http://www.pbs.org/teachersource/mathline/lessonplans/esmp/chances/chances_procedure.shtm – PBS lesson plan on probability.

Released SOL test items

37 The table below shows the different colors and kinds of shirts that a club member can choose from.

Shirt Choices

| Color	Kind of Shirts
Green	T-shirt
White	Tank top
	Sweatshirts

Which of the following lists all the different ways to combine 1 color and 1 kind of shirt?

A Green, T-shirt
   Green, Tank top
   Green, Sweatshirt
   White, T-shirt
   White, Tank top
   White, Sweatshirt

B Green, T-shirt
   Green, Tank top
   White, Tank top
   White, Sweatshirt

C Green, Tank top
   Green, Sweatshirt
   White, T-shirt
   White, Tank top
   White, Sweatshirt

D Green, T-shirt
   Green, Sweatshirt
   White, Tank top
   White, Sweatshirt

43 Louis bought these cans of food.
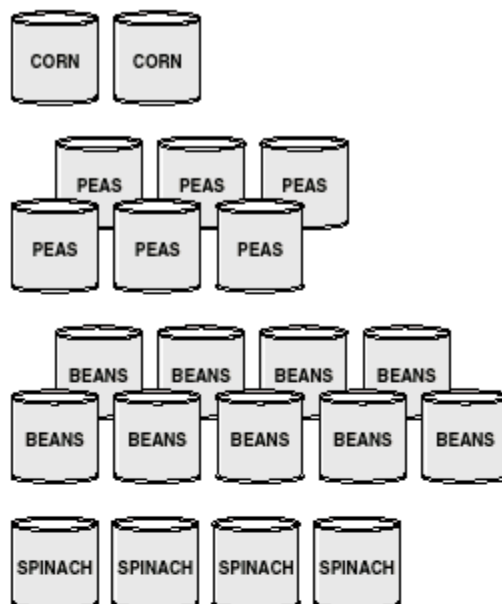
If Louis picks one can from the bag without looking, which kind of can is he LEAST LIKELY to pick?

A CORN

B PEAS

C BEANS

D SPINACH
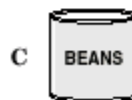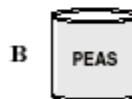
Organizing Topic   Patterns, Functions, and Algebra

Standards of Learning

3.24   The student will recognize and describe a variety of patterns formed using concrete objects, numbers, tables, and pictures, and extend the pattern, using the same or different forms (concrete objects, numbers, tables, and pictures).

3.25   The student will
   a) investigate and create patterns involving numbers, operations (addition and multiplication), and relations that model the identity and commutative properties for addition and multiplication; and
   b) demonstrate an understanding of equality by recognizing that the equal sign (=) links equivalent quantities, such as 4 • 3 = 2 • 6.

Essential understandings, knowledge, and skills	**Correlation to textbooks and other instructional materials**
The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to	
• Recognize repeating and growing numeric and geometric patterns (e.g., skip counting, addition tables, and multiplication tables).	
• Describe repeating and growing numeric and geometric patterns formed using concrete objects, numbers, tables, and/or pictures, using the same or different forms.	
• Extend repeating and growing numeric and geometric patterns formed using concrete objects, numbers, tables, and/or pictures, using the same or different forms.	
• Recognize that the equals sign relates equivalent quantities.	
• Write number sentences to represent equivalent mathematical relationships (e.g., $4 \cdot 3 = 2 \cdot 6$).	
• Identify number sentences that show appropriate use of the equals sign.	

Patterns on the Hundred Chart

Reporting category   Patterns, Functions, and Algebra

Related Standards of Learning 3.24

Objective

- Students will recognize and describe patterns on the hundred chart.

Materials needed

- An overhead transparency or a large hundred chart for display
- "Hundred Chart," at least two copies for each student
- Crayons, markers, or counters in at least two colors
- Calculators (optional)
- "0–99 Chart," one copy for each student (optional)

Instructional activity

1. *Initiating Activity:* Give each student a copy of the chart and a handful of counters. Make several patterns on the overhead while the students duplicate them on their chart. Explore the chart with them and ask what patterns they see. For example, a student might say, "I see a pattern in the second column. The ones digit is always 2 and the tens digit goes up one until you get to 9."

2. Introduce other patterns. For example, have everyone place counters on the multiples of two (skip count by twos). Ask the students to describe the pattern made. Have the class put their heads on their desk while you remove several counters or move them to another place. Have the students raise their heads and tell you which counters were moved and how they know they were moved.

3. Explore with the group other patterns formed by multiples of other numbers, using the chart. After exploring several patterns, group the students into pairs or small groups. Assign each pair or group a number and have them cover that number and its multiples with counters. If two groups have the same number, have them compare the patterns and discuss any similarities or differences they find. If there are differences, have them explain why those differences occur.

4. Explore patterns in different ways.

5. Have the class place counters on all the numbers that have a 3 in the ones place. Describe the pattern.

6. Have the class place counters on all squares that contain the digit 7. Describe the pattern. How many of the 100 squares have a counter on them? Try this with other digits. Do you always get the same result? Why or why not?

7. Have the students cover the multiples of two with a counter. Then have them cover the multiples of three with a different color counter. Which squares have two counters on them? Why?

8. Have the students find and cover 8, 17, 26, 35, 44, 53, 62, and 71. Have them describe the pattern they see. (Each number is one square down and one square to the left.) Now discuss the numerical pattern. (Nine more than or counting on by 9s. Counting on by 9s is the same as adding 10 and then subtracting 1.) Have the students add the digits in each square and discuss their observations. (The sum is always 8.) Ask them to explain why this is true. Are there other similar sequences?

9. Have the students find and cover 3, 14, 25, 36, 47, 58, and 69. Have them describe the pattern they see. (Each number is one square down and one square to the right.) Now discuss the numerical

pattern. (Eleven more or counting on by 11s. Counting on by 11s is the same as adding ten and then adding 1.) Have the students add the digits in each square and discuss their observations.

Sample assessment

- The use of the hundred chart allows for quick assessment of a student's understanding. Watching students place the counters on their chart (placed with confidence or reluctance) will give the teacher a quick assessment of concept understanding. Listening to students' explanations for a given pattern will help clarify their thinking.

Follow-up/extension

- Different patterns emerge with a different configuration of the board. Try some of the same patterns on a 0–99 chart. Additional patterns to explore:
  ° Mark all the numbers with both digits the same.
  ° Mark all the numbers with digits that add to eight.
  ° Mark all the numbers with first digits that are larger than the second digits.
  ° Mark all the numbers with a 4 in them.
  ° Mark all the numbers with digits that add to 10.

Hundred Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

0–99 Chart

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Exploring Multiples

Reporting category	Patterns, Functions, and Algebra
Overview	The hundred chart offers students a visual way to look at patterns that lead to a generalization of multiplication.
Related Standard of Learning	3.25

Objective

- Students will be able to show multiples on a hundred chart and make predictions based on the observed patterns and graphs.

Materials needed

- "Hundred Chart," one copy for each student
- "Multiplication Table Worksheet," one copy for each student
- "Recording Sheet," one copy for each student

Instructional activity

Skip counting can furnish practice with multiples while deepening students' understanding of multiplication facts. Students are able to observe visual patterns resulting from identifying the multiples of a number. Note: Use a hundred chart that begins with 1 instead of 0.

1. Beginning with the number 2, students will skip count by 2s, marking the multiples of 2 with a unifix cube. Students will begin placing the unifix cubes as they skip count, however, many students will soon see the pattern and begin placing the cubes using the pattern rather than the skip counting. Have students describe the pattern.

2. Students will skip count by 3, 4, 5, etc., up to 12. It is important that students be able to describe the pattern verbally.

3. At a later time, have students repeat the previous activity. This time, have students record their findings on the Recording Sheet. After they have skip counted by 3, for example, ask the students what number is under the fourth 3. When they respond "12," ask them what they think 4×3 equals. Continue this type of questioning so that students understand the relationship between skip counting the multiples and multiplication.

4. Have students look at the Recording Sheet. What are the differences and similarities among the patterns? Is 239 a multiple of 6? How do you know? If a number is a multiple of 6 is it a multiple of 2? Of 4?

5. Have students look back at the recording sheets where they marked all of the multiples and transfer these findings to the Multiplication Table worksheet. Discuss the patterns that were found.

Follow-up/extension

- Skip count by 2 and then by 3, marking the multiples of 2 with one color and the multiples of 3 with a different color unifix cube. Which numbers have two colors on them (6, 12, 18, ...) Why? Why is "Common Multiples" a good name for this set of numbers?

Sample assessment

- Journal Entry: Explain what is meant by the term *multiple*.

Hundred Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

RECORDING SHEET

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
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81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Multiplication Table

X	1	2	3	4	5	6	7	8	9
1									
2									
3									
4									
5									
6									
7									
8									
9									

Scales and Seesaw Balances

Reporting category	Patterns, Functions, and Algebra
Overview	Students balance a scale by using rainbow cubes as the manipulative of choice.
Related Standard of Learning	3.25

Objective

- Students will be able to balance the scale with a variety of different combinations of rainbow cubes by placing the colored cubes on provided shapes.

Materials needed

- Rainbow Cubes or other cubes or counters
- "Balance Scale" worksheet, one copy for each student
- Overhead projector
- Overhead Transparency of the Balance Scale
- Transparency of a Seesaw Balance
- "Seesaw Balances" worksheets, one set for each student

Instructional activity

Part I

1. Display the "Balance Scale" transparency on the overhead projector.
2. Explain to students that they can balance the scale by placing rainbow cubes in the square, circle, and triangle shapes on the scale
3. Instruct students that they must follow the rules that you will list on the board or on chart paper:
   - Shapes that are the same must hold the same numbers of cubes.
   - Shapes that are different must hold different numbers of cubes.
   - All shapes must hold some cubes.
   - The two sides must balance by holding equal numbers of cubes all together.
   - You may use a total of 10, 15, or 20 cubes.
4. Assign each student a partner and ask each pair to balance their Balance Scale using 18 rainbow cubes. Be sure to remind the students to follow all the rules.
5. Work on the chalkboard or overhead to create a table that will track students' differing solutions.
6. Instruct students to attempt to balance the scale again, this time using 10, 15, and finally 20 rainbow cubes.
7. Encourage students to record their findings so that they will be able to explain how they balanced the scale each time.

Part II – Seesaw Balances

1. Display the overhead transparency of a seesaw balance on the overhead projector.
2. Explain to students that they will be assigned weights for some of the characters represented on the seesaw.

3. Instruct the students that they are to calculate a numeric value for each of the characters.
4. Remind students to follow all the rules:
   - Balance the seesaw.
   - Gobots that are the same have the same weight.
   - Gobots that are different have different weights.
   - All gobots weigh more than zero pounds.
5. Encourage students to work with a partner to discover as many solutions as possible for each problem. Have students discuss strategies they used to determine solutions; e.g., working backward, guess and test, looking for patterns.

Sample resources

Patterns, Functions, and Algebra Staff Development Module – available at the VDOE Web site.

http://standards.nctm.org/document/chapter5/alg.htm#bp1 – NCTM Principles and Standards information related to the algebra strand in Grades 3-5.

http://www.pbs.org/teachersource/mathline/lessonplans/atmp/snake/snake_procedure.shtm – Students describe, use and extend several stages of an imaginary snake's growth pattern.

http://www.illuminations.nctm.org/lessonplans/3-5/variablemach/index.html – a lesson plan that provides an introduction to the use of variables.
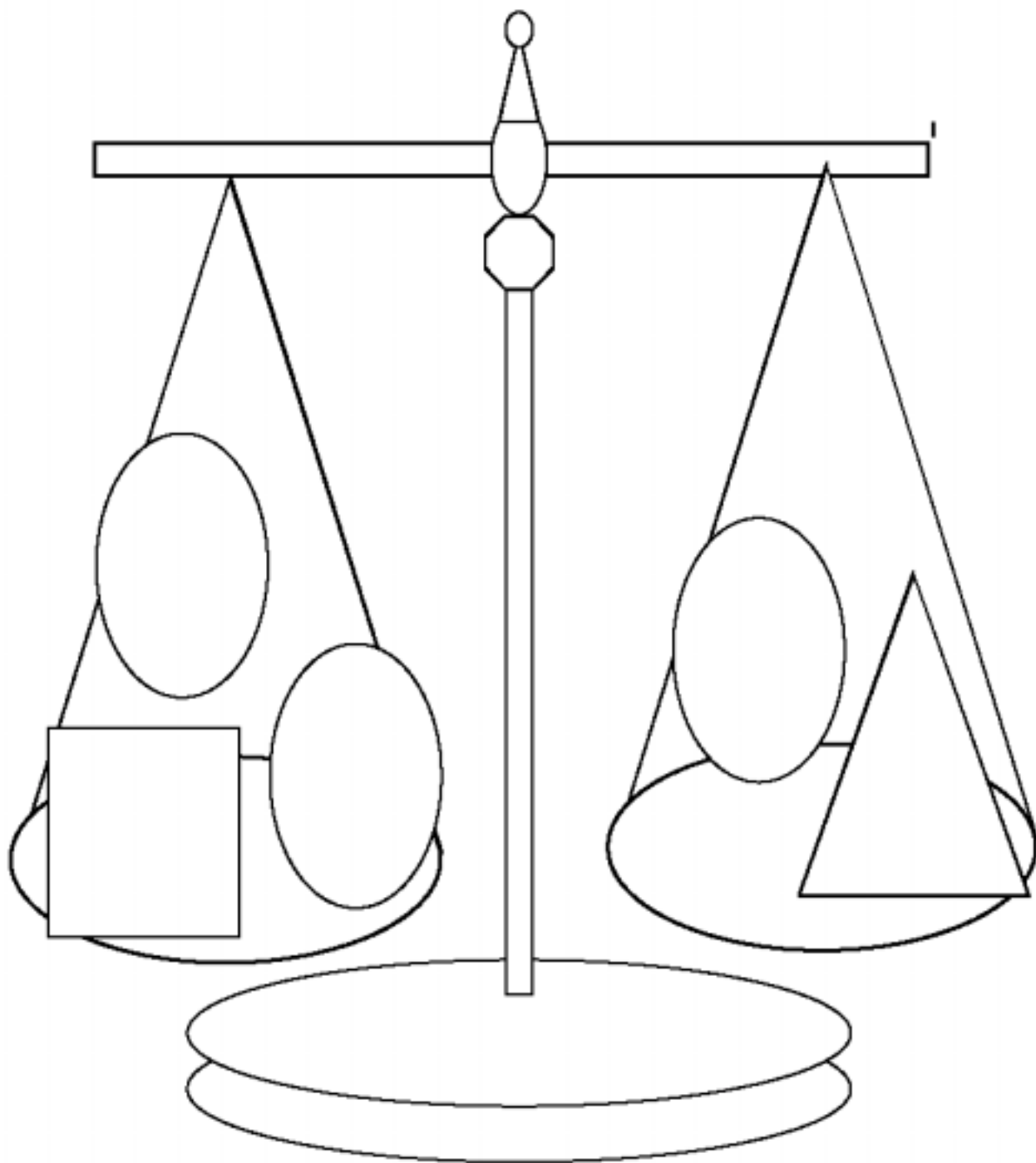
Same Shapes Must Hold Same Numbers

SEESAW BALANCES

If on the seesaw weighs four pounds, what could the other gobots weigh?

| 4 | 1 | 3 |
| 4 | 3 | |

If on the seesaw weighs seven pounds, what could the other gobots weigh?
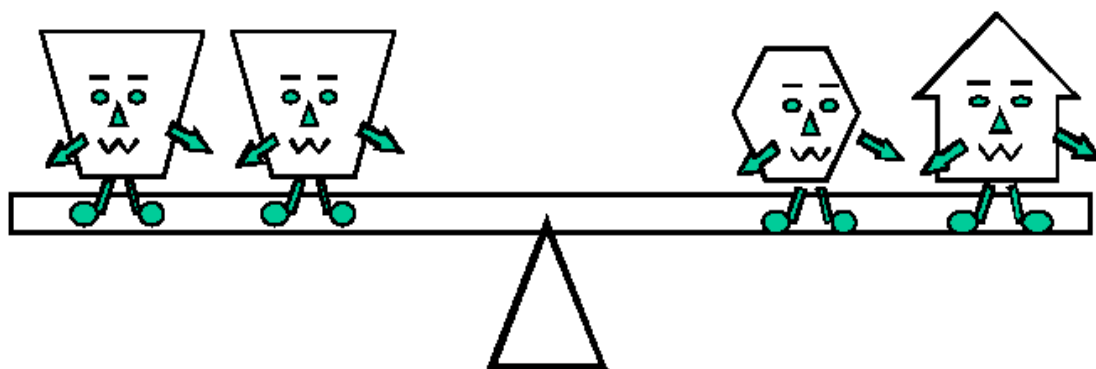
SEESAW BALANCES

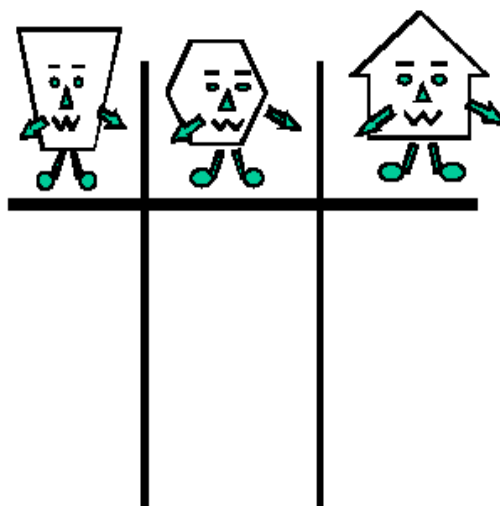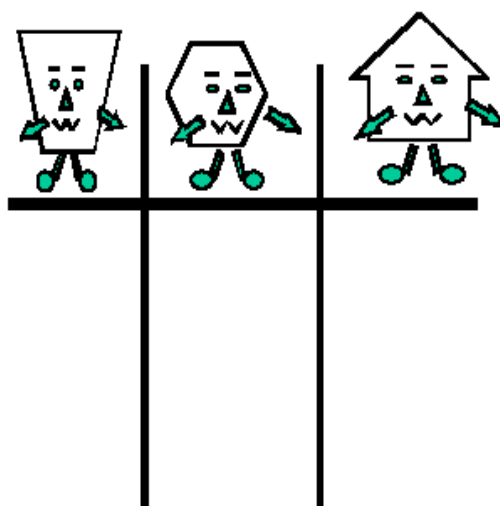If on the seesaw weighs three pounds, what could the other gobots weigh?

3

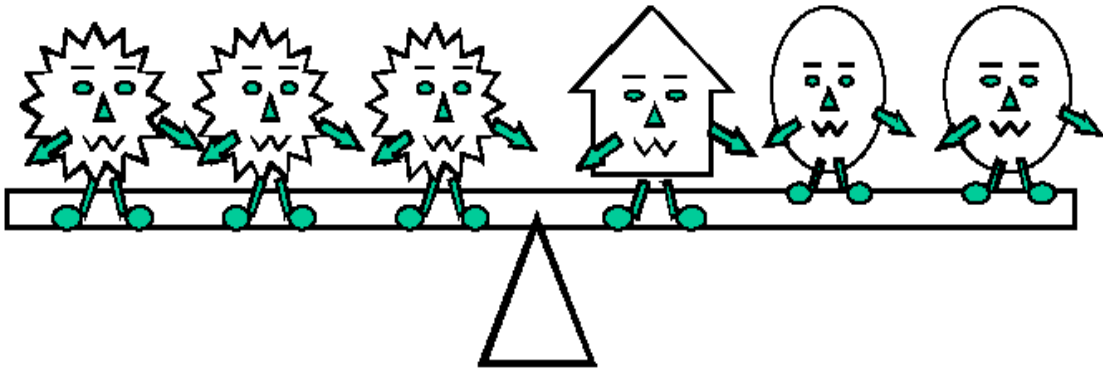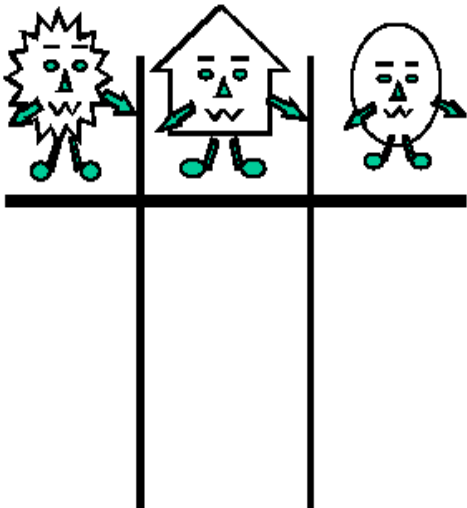If on the seesaw weighs four pounds, what could the other gobots weigh?

SEESAW BALANCES

If on the seesaw weighs three pounds, what could the other gobots weigh?

If on the seesaw weighs five pounds, what could the other gobots weigh?
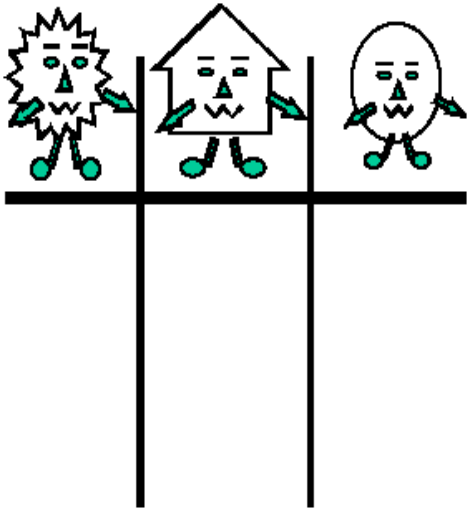
SEESAW BALANCES

If on the seesaw weighs five pounds, what could the other gobots weigh?

If on the seesaw weighs six pounds, what could the other gobots weigh?

Released SOL test items

44 Look at the pattern of shapes below.

If the pattern continues in the same way, what will be the next shape?

F

G

H

J

45 The table below shows the number of paddles Mr. Watson must order for different numbers of canoes.

Number of Canoes	2	4	6	8	10
Number of Paddles	4	8	12	16	?

If the pattern in the table continues, how many paddles must be ordered for 10 canoes?

A 17
B 18
C 20
D 23

46 Lexi had 6 fish in her fish tank. Her dad bought her some more fish. After that, Lexi had 14 fish in her tank. How many fish did Lexi's dad buy for her?

F 8
G 9
H 12
J 20

47 The table below shows the cost of different numbers of rulers.

Ruler Costs

Number of Rulers	Total Cost
1	25¢
2	50¢
3	75¢
4	$1.00
5	$1.25
6	?

If the pattern in the table continues, what will 6 rulers cost?

A $1.30
B $1.50
C $1.75
D $2.00

48 The table below shows the times that the train leaves from each station.

Station	Time
Westin	5:00
Lee	5:06
Carson	5:12
Burr	5:18
Madison	

If the pattern continues, what time will the train leave the Madison station?

F 5:19

G 5:20

H 5:24

J 5:26

49 Look at the pattern of shapes below.
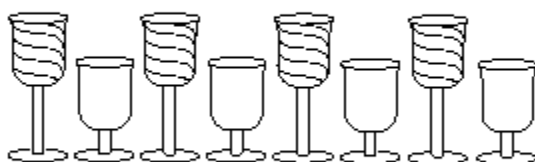
Which of the following shows the same kind of pattern?

A

B

C

D